SCIENTIFIC AMERICAN

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A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CII.—No. 3. ESTABLISHED 1845.] NEW YORK, JANUARY 15, 1910. [10 CENTS A COPY. $3.00 A YEAR.

THE MACHINE-HORSE OF THE MODERN FARMER.—[See page 50.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

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361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) ..... $3.00 a year
Scientific American Supplement (established 1876) ..... 5.00 "
American Homes and Gardens ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, JANUARY 15th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE 1910 AUTOMOBILE.

CONVINCING evidence that the automobile of to-day is as far perfected as the materials of construction and mechanical ingenuity will allow, is afforded by the fact that the cars shown in the two annual exhibitions this year exhibit no novelties of a radical character as compared with the cars of the preceding year. Indeed, were it not for the relatively short life and high cost of the tires, the automobile would surely be entitled to rank as the most perfect and economical means of transportation of the present day. As to whether some cheaper and more durable substitute, having the same resiliency as rubber, will be found during the immediate future, we can only say that there is not at present, as far as we know, any promise that such a substance will be produced. At the same time, the development of the car has been along lines that are highly favorable to the life of the tire; for both the weight and the horse-power have been greatly reduced. Moreover, the average owner is beginning to understand that the exercise of discretion in the use of the brake, in avoiding rough places on the road and in slowing down at curves, will add from fifty to one hundred per cent to the life of the tires.

The tendency toward standardization is even more marked this year than last, and the freak car is conspicuous by its absence. The predominance of the four-cylinder motor would indicate that this is to be the prevailing type of the future. The six-cylinder motor is being made; but in spite of its acknowledged advantages of more even torque, etc., it is mainly confined to expensive cars of high power. An encouraging feature, based upon thoroughly sound mechanics, is the increased length of stroke; two of the leading makers exhibiting 30-horse-power cars with cylinders 3½ inches by 5 inches stroke and 3¼ inches by 5 inches stroke respectively.

Undoubtedly, the present flood tide of prosperity in the automobile industry is due largely to the fact that a multitude of people of moderate means, who have been waiting until a thoroughly serviceable car embodying the latest improvements was placed on the market at a low price, is now being accommodated. Several makers are offering a four-cylinder 20-horse-power car, having all the features of stylish design, accessibility to the parts, and ease and certainty of control, of the more costly designs, for the low price of $750. Cars of this type have proved during the past year that, with judicious handling, they are perfectly well able to stand up under constant and severe service. For all cars, the four-cylinder, four-cycle engine, with variations in the valve arrangements to suit the tastes of the various builders, has become the standard type; and the indications are that ultimately the cylinders will be cast *en bloc*. Crankshaft ball bearings have given place to babbitt parallel bearings of liberal area, although a few first-class makers are using a modified ball bearing with an outer rotating ring. For axles, although a few still use the balls, the roller bearing seems to be established as the standard practice.

There is a practically universal use of high-tension ignition. All machines, down to the lowest priced, use magnetos, with either a four-cylinder coil and timer as auxiliary, or a dual system of ignition. The shaft drive is in almost exclusive use, the chain being retained only on very large cars. The transmission, except on the smallest cars, is almost invariably of the sliding and selective type, with three speeds ahead and one reverse, and the excellent results obtained by those firms which have placed the transmission on the rear axle are bringing this arrangement into general favor.

Lubrication is effected mainly by two systems; one employing "splash" lubrication, in which the cranks pass through a bath of oil contained in the bottom of the crank case, and the other employing a trough and a pump, which causes a constant and positive circulation through every bearing. Outside of a tendency to enlarge the size, there are no notable changes in the valve mechanism of American cars; and it is rather remarkable that, in spite of the increased use which is being made abroad of the slide valve (a distinctly American invention), there seems to be no disposition to develop this type in the land of its birth.

Although the multiple-disk clutch bids fair to become the exclusive type abroad, the familiar, leather-covered cone clutch has rendered such excellent service on American machines that it still holds its own, and this in spite of the fact that the multiple-disk type has been giving good results on such American cars as carry them.

In the manufacture of car bodies, there is a marked tendency toward the adoption of straight-line designs. Several stylish-looking cars, both of medium and high power, are shown with the much-talked-of torpedo body, in which both the front and rear seats are entirely inclosed, the cars being provided with side doors, forward as well as behind. The provision of doors that open toward the front instead of toward the rear is commendable, both from the standpoint of convenience and safety. An additional advantage of the torpedo body is that it provides excellent protection against the rush of air, particularly on high-speed cars. A notable tendency of the times is the growing popularity of wind shields and "tops," the appreciation of the former being due largely to the general objection to wearing goggles. The use of tops renders the motorist comparatively independent of the weather, and they unquestionably add to the all-round comfort of touring.

The question of the relative advantages of the right-hand and left-hand drive is coming to the front, and some makers are offering cars with steering wheel placed at the left of the car. Unquestionably the right-hand position is preferable in those foreign countries where the rule of the road in meeting and passing is the opposite of our own. There, in meeting a car one passes to the left; and the driver, if seated on the right of the car, is in a favorable position for judging of the necessary clearance. In this country, where the rule of the road is reversed, it would seem logical also to reverse also the position of the driver.

The handsome display of motor trucks forms perhaps the most notable feature of this year's exhibition, no less than seventeen different makes of commercial motor vehicles being shown at the Grand Central Palace. In quality of design and workmanship, and in the variety of uses for which the vehicles have been built, this section compared favorably with the best work shown in the other automobile exhibits; and as one passed from one to another of these powerful machines and noted the excellent combination of compactness and great capacity, the impression became strong that at length, after many years of discouragement, the motor vehicle had come into its own. Certainly the statistics of the trade bear out this conviction; for it is estimated that during the coming year about fifty thousand commercial vehicles will be built in this country alone. This gratifying result is the outcome of several years of careful experimental work, in which wholesale houses, department stores, express companies, and the big brewing concerns have been trying out various designs of vehicles under widely different conditions of traffic, both in summer and winter. That the manufacturers themselves have faith in the future of the industry is proved by the fact that, in several cases, they are considerably enlarging their plants to meet an expected increase in the demand; and one firm alone in the West, is to-day in a position to turn out five thousand motor vehicles for commercial use during the present year.

IMPROVED QUALITY VERSUS PRICE REDUCTION.

FIVE years ago or more, when a man paid $2,000 or $2,500 for a touring car, or $650 to $1,200 for a runabout, he scarcely expected to get much in the way of reliability and durability—or, if he did, in the exuberance of unsophisticated anticipation, he was pretty sure to be disappointed before he had used the car many days. The narrative of an automobile run in those days was usually a recital of a series of troubles of various sorts, chiefly with tires, carbureter, and ignition, but also frequently with breakages and imperfect functioning of valve mechanism, shafts, gears, chains, and even steering knuckles, driving axles, and other vital parts.

Conditions are very different in the present state of automobile development, when it becomes a matter of surprise to even well-posted observers that eight out of thirty cars taking part in the Glidden tour of 1909 should finish an arduous trip of 2,640 miles run between Detroit, Chicago, Minneapolis, St. Louis, Denver, and Kansas City in fifteen days at an average speed of twenty miles an hour during the daylight running periods, without suffering a single involuntary stop for repairs, or for adjustments of any sort on the way except to brakes, carbureter, the ignition system, and tires. Considering the road and weather conditions under which the work was done and the lack of daily inspection, cleaning, and adjusting, this probably represents a higher degree of efficiency and performance than can be shown for any other mechanical construction.

The wonderful improvement in motor-car quality made evident by the results of this test and by a comparison of the specifications of the machines of to-day with those of machines selling at about the same prices in the early part of the decade now drawing to a close, is due to a number of contributing causes, but to none more than to the production and use of special grades of steel, bronze, aluminium, and babbitt having certain definite physical properties suited particularly to the requirements in different parts of the automobile. The manufacture of first-class or even reasonably satisfactory motor cars in this country was practically impossible until the then small group of experimenters and builders were able to convince the metal manufacturers of the large possibilities of the automobile industry, and thereby induce them to undertake the production of nickel steel and chrome nickel steel for use in crankshafts, transmission shafts, driving axles, sliding, differential, and steering gears, steering knuckles, and similar parts, and of manganese bronze, phosphor bronze, and various aluminium alloys for use in crankcases, gear boxes, steering-gear housings, and similar parts demanding great stiffness combined with light weight. The automobile industry is very largely responsible for the discovery of the physical properties of chrome-nickel steel and vanadium-chrome steel under different modes of heat treatment, as annealing and oil tempering, and for the introduction of the special tool steels required to work them.

Before the special alloy steels were brought out, the motor-car manufacturers nearly reached the end of their resources in the effort to produce safe, durable cars of satisfactory power and speed without excessive weight. The transformation that has been wrought can be better comprehended when it is shown that it is not uncommon for specially treated chrome-nickel or vanadium-chrome steel to show a tensile strength of more than 200,000 pounds per square inch as compared with 50,000 pounds tensile strength of fibrous iron of a quality used by wagon makers and also employed for certain purposes in automobiles. That is, a bar of the alloy steel one inch square is capable of sustaining a load of 100 tons without breaking. The qualities most sought in metals for sliding gears, crankshafts, camshafts, driving and differential pinions and gears and live rear axles are elasticity to resist torsional stresses and impact, hardness to resist wear, and ductility to bend under heavy shock instead of snapping. But ductility must be subordinate to elasticity, as it was found in the earlier days of the industry that the soft Swedish iron and low-carbon Bessemer crucible steel would take a permanent set under the repeated shocks and stresses, and throw the shafts and gears out of alignment.

As a result of the employment of steel of such wonderful strength in the sliding-gear sets, by way of illustration, it is now possible to transmit the 40 and 60 horse-power of the modern touring car with smaller and lighter gear sets than were used in cars of 12, 15, and 20 horse-power five years ago, and that with much greater certainty against breakage and the practical elimination of the mangling of the ends of the teeth by meshing and of wear due to contact under load. By the similar use of special metals in all parts of the machine that must sustain heavy torsional stresses, frequent and heavy impact, or much friction, the designer has been enabled to keep down the weight while constantly increasing the strength and life of the machine as a whole. This accounts for the great speed, power, quick acceleration, perfect manageability, and the dependability and durability of the cars of to-day weighing little if any more than machines of a quarter or third the power and half the speed, built during the first half of the decade.

All this improvement in quality, plus infinitely more grace in general lines and in comfort to the passengers, and a complete equipment of folding top, wind shield, head lights, magneto, and other expensive fittings, is offered to the buyer almost at no advance in cost over the ungainly, uncomfortable, and poorly-equipped cars of six and seven years ago.

The high steam shovel record for August on the Panama Canal excavation was made by a shovel working in the Culebra District, which excavated 45,694 cubic yards of earth in twenty-six working days. A shovel working eight days in the Culebra District and eighteen days in the Empire District excavated 16,755 and 26,518 cubic yards, respectively, a total of 43,273 cubic yards, the second best record for the month. A third shovel in the Culebra District made the high record for one day by excavating 2,549 cubic yards of rock and earth.

ENGINEERING.

The Jungfrau railway, which has formed the subject of illustration in this journal, is making steady progress. About 130 men are engaged on the tunnel between Eismeer station, 10,345 feet, and the Jungfrau Joch, 11,090 feet above the sea level. The present indications are that the road will be completed toward the close of next year.

At the last meeting of the American Society of Naval Architects and Marine Engineers, in a paper on "Applications of Electricity to the Propulsion of Naval Vessels," Mr. W. L. R. Emmett estimated the efficiency of the turbo-electric installation at 92 per cent; and he, at least, is of the opinion that no other form of speed reduction between turbine and propeller can be made to show equal efficiency.

In a recent article in one of the magazines, Admiral Evans takes a rather pessimistic view of the future of the Panama Canal. He sees but little revenue in prospect; and apparently he holds the view that, unless the canal be declared free to all navigation, it will succeed in attracting but a limited amount of shipping. He seems to be of the opinion that it cannot possibly charge a sufficient toll, at least during the early years of its operation, to pay the heavy fixed and operating charges.

A prize of $5,000 has been offered in England for a twenty-four-hour aeroplane motor. In weight the engine must not exceed 245 pounds, and it must develop not less than 35 brake horse-power. The points to be considered in making the award will be weight, fuel consumption, reliability, wear of working parts, security against fire, and minimum air resistance. The conditions are severe, but unquestionably the motor is the weak point in the aeroplane at the present stage of its development.

Emphatic testimony to the ability of reinforced concrete to resist earthquake shock is given by the experts who were sent by the Japanese to Messina. The buildings that had been constructed of armored concrete, according to Prof. Amore, proved to be highly resistant; and much significance was attached to the case of two reservoirs of considerable size, one of brick and the other of reinforced concrete. The concrete structure received no injury, whereas the brick reservoir was completely destroyed.

Recently gathered steam turbine statistics, referring to the growth of this new type of engine in public favor, show that although the first steamer was equipped with turbines as recently as 1901, there are now sixty-four vessels carrying this equipment, the aggregate horse-power represented being 603,200. It is estimated that because of the lower pressure which can be used with the turbine, no less than 120 tons of weight was saved in the boiler room of the largest of the turbine-propelled liners.

Statistics published by the Interstate Commerce Commission show that during two years, out of 152 preventable collisions and derailments, twenty-one of the accidents were due to the failure of the locomotive engineers to observe the signals. Evidently the human element enters largely into the question of the efficiency of block signaling. In view of this fact, it is encouraging to note the steady growth of automatic stop devices which, in case of failure of the engineer to obey a signal, will open the train pipe and set the brakes.

With a view to guarding the safety of passengers and preserving the life of rails and rolling stock, the Chicago, Milwaukee, and Puget Sound Railway will refrain from running high-speed trains over the new roadbed until it has had time to become thoroughly compacted and a reasonable amount of stone or gravel ballast has been tamped beneath the ties. It takes some time for embankment and ballast to settle into place; and, apart from the risks of operation, the running of fast heavy trains over new track entails costly work in renewals and upkeep.

Any one who was familiar with the appearance of the Niagara Falls before the present power installations were built and opened, can settle the question as to whether the appearance of the falls has been affected, by the simple expedient of going to see for himself. Small though the total amount of water taken for power purposes, in proportion to the total amount passing over the falls, may be, it has been sufficient to cause the shallower portions of the overflow at the edges of the falls to become entirely dry, thereby greatly reducing the total length of the crest line.

During the last month of 1909, electric service was inaugurated on the newly electrified portion of the London, Brighton and South Coast Railway, London, the particular portion placed in such service being known as the South London Line, which extends nine miles from Victoria to London Bridge. Formerly the running time of this trip was thirty-six minutes; now it is twenty-five minutes, and trains run at ten-minute intervals. Operation is by the overhead alternating-current trolley, and the motor cars are each fitted with four 120-horse-power single-phase motors.

ELECTRICAL.

A recent press report states that a chain of wireless stations is to be established by the British Admiralty in the Pacific Ocean. High-powered stations will be placed at Sydney, Doubtless Bay, New Zealand, Suva, the capital of the Fiji group, and Ocean Island, with medium-powered stations in the New Hebrides and Solomon Islands.

A new device for connecting wires has just been put on the market. It consists of a sleeve adapted to fit over the wires, which is filled with a requisite amount of solder. The sleeve is furnished with material which when ignited produces sufficient heat to melt the solder. The wires are then jammed together within the sleeve and firmly soldered in this position. The device requires no torch or soldering iron, as the inflammable material can be ignited with a match. The advantages of such a system of connecting wires will be appreciated by those who have tried to solder joints on overhead lines.

The voltage on power-transmission lines has been rapidly increasing, and at such a pace as to almost take one's breath away. This development has required a similar advance in the design of transformers capable of taking the high-tension current and reducing it to a lower and more serviceable voltage at the points of distribution. The latest transformers of this type have a capacity of 3,750 kilowatts, and are capable of taking a maximum voltage of 138,500 and reducing it to 12,100. These transformers have been built for the Stanislaus Power Company of California. Each transformer unit weighs about 28 tons complete, stands 17 feet high, and occupies a floor space of 9½ by 5½ feet.

For the past three years meat has been cured by electricity in much less time than was required by the old method. The meat is placed in large wooden tanks and covered with the ordinary pickle. An alternating current of 35 amperes at 35 volts is passed through the vat, the alternations serving to prevent electrochemical action. Carbon electrodes are used, which are surrounded by porous cups that dip into the brine. The cost of curing a vat full of meat (four thousand pounds) is less than one dollar. The action of the current is not perfectly understood, but it appears to drive the pickle into the meat and hasten the cure. It also appears to preserve the pickle and prevent its deterioration, except for the loss of ingredients taken up by the meat.

According to La Lumiere Electrique, a new microphone has been constructed by Messrs. Carl Egner and J. Kannar, of Holmstroem, Sweden, which will withstand a current of ten to fifteen amperes. The details of the instrument are not given out, owing to the fact that it has not yet been protected by patents. The Swedish government recently connected several telephone lines, forming a line nearly nineteen hundred miles long, and the microphone transmitted speech very clearly over this circuit, whereas with the ordinary apparatus no audible sounds were produced. The new transmitter is being used in the Poulsen wireless telephone system, and it is claimed that conversation has been carried on over a distance of 175 miles, using a high-frequency current of six amperes.

The Navy Department is giving its earnest support to the bill introduced by Mr. Roberts, who is a member of the House Committee on Naval Affairs, to control amateur wireless telegraphy. Mr. Roberts's measure calls for a board consisting of seven members, one expert each from the Navy, War, and Treasury departments, three experts representing commercial wireless telegraph and telephone interests, and one scientist who is well versed in wireless telegraphy and telephony. It is proposed that the operations of the amateur telegraphers be confined to certain hours of the day, and that each operator be required to take out a license. The Navy Department has recently forwarded to Mr. Roberts extracts from the logs of revenue cutters, showing some of the difficulties with which naval wireless operators have to contend.

With characteristic thoroughness the Prussian Government Railways have been investigating the best roadbeds for their lines; also the best trolley systems and motors. About 20 miles from Berlin is an oval-shaped experimental railway of about a mile in length. Part of the roadbed consists of wooden ties, and another part of metal ties. Various kinds of ballast are used, and various methods of connecting the rails and ties. Over this experimental railway an electric train is operated every weekday for about twenty hours of the day, and in this way it is possible to determine which form of roadbed will best stand the wear of actual service. The overhead system has been changed from time to time, and different forms of collectors have been used. At present the locomotive on this line is being driven by Winter-Eichberg single-phase motors geared to the wheels. The company expects soon to use motors mounted on the floor of the locomotive, and crank-connected to the driving wheels.

SCIENCE.

A moving picture operator was taken up by Latham recently on a seven-minute trip, at an elevation of eighty feet from the ground. He took pictures with the lens pointing downward. The apparatus weighed 200 pounds, and its operator 196.

There seems to be some evidence that pulsatory oscillations of the earth's crust increase where there is a strong barometric gradient, without any relation to the wind. The phenomenon has been investigated by two Japanese scientists, one of whom, Omori, has shown that the earth's pulsations are due to changes in the pressure upon the earth's crust caused by barometric changes or by accompanying changes in the sea level, but not due to the wind itself. Shimono, the other Japanese, has carried on Omori's observations and made a special study of the case of August 4th-7th, 1909, when a depression approached Osaka from the south, finally passing off to the northeast. He obtained records of pulsations with components of 0.06 and 0.07. Other cases also support Omori's view.

The blanket effect of clouds, their power of conserving terrestrial temperatures, is discussed by Mr. W. W. Coblentz in a recent number of the Monthly Weather Review. He says that this blanket effect of clouds is due to their high emissivity for radiations emitted by the earth and hence to their high efficiency as heat radiators. A "black body" should have no reflecting power and be opaque. Water reflects only from 2 to 5 per cent of the waves received, and a layer 1 centimeter thick absorbs completely all radiation of wave length greater than 1.5 μ in the infra-red. The earth's maximum emission lies in the region of 8 μ, and less than 1 millimeter thickness of water is required to produce complete opacity in that region. Owing to this opacity there is little internal reflection of heat-waves in the water globule.

The ironing of linen may have a greater effect than is expected of it. As the temperature of the iron may greatly exceed 266 deg. F. it has been suggested that the process of ironing may suffice to sterilize surgical dressings and hence be of valuable service, especially in rural districts and elsewhere, in the absence of disinfecting ovens and sterilizers. Nearly all microbes can be killed by a sufficiently long application of a temperature of 158 deg. F., but a temperature of 266 deg. F. is required to kill certain spores of bacteria and to produce absolutely complete sterilization. It has been proved by experiment that it is possible to disinfect clothing very satisfactorily by ironing. Clothing which had been worn by children affected by various contagious diseases and which contained bacteria of pus, diphtheria, etc., was sprinkled and ironed. It was then rubbed on plates of gelatine prepared for the culture of bacteria, but not a single colony was developed.

Prof. Joly has studied the radio-active properties of the many lavas, especially those of Vesuvius. From his results it appears that the Vesuvian lavas, from 1631 to the present day, are remarkably rich in radium compared with other lavas, the values ranging up to three times the normal for igneous rocks, and sometimes even higher than that. The thorium content, although large in comparison with what generally prevails in the rocks of the St. Gothard series, is not conspicuously higher in the Vesuvian rocks than in the rocks from other volcanoes. The highest reading was obtained from the Krakatao pumice. The Vesuvian lavas appear to show a progressive increase of radio-activity according as they are of more recent eruption, which seems to indicate that, as time progresses, this volcano is tapping materials richer and richer in radium. Prof. Joly has also discussed the possibility of a connection between radio-activity and volcanic activity.

Not so long ago Prof. Turner proved that gold leaf becomes transparent when heated in contact with glass. This interesting phenomenon has been further studied by Messrs. J. C. Chapman and H. L. Porter without the use of glass. In their experiments a piece of gold leaf was held by its edges to a platinum loop and heated in a double-walled quartz crucible. As heating continued it was noticed that the gold leaf was becoming more taut, and eventually the tension became so great that the leaf tore in places. Hence at a sufficiently high temperature gold leaf contracts. On examining it microscopically after removal its structure appeared to be decidedly more granular. Subsequent experiments with the leaf hanging like a blind with a weight at the bottom to put it under definite tension showed that as the temperature rose the contraction when it began took place at a great rate with increase in temperature. When different tensions were employed the contraction temperature was nearly the same in all, and was about 340 deg. C. With gold wire instead of leaf no contraction took place. The extra transparency when the leaf is heated in contact with glass is attributed to this contraction, it being shown that the leaf tears on contraction at numerous places, leaving clear intervals between.

THE MOTOR CAR AND THE ROAD.

THE DESTRUCTIVE EFFECT OF HIGH SPEED.

BY LOGAN WALLER PAGE,

DIRECTOR OF THE OFFICE OF PUBLIC ROADS, UNITED STATES DEPARTMENT OF AGRICULTURE.

The most serious and difficult problem now engaging the attention of highway engineers all over the world is the preservation of the crushed stone road under the destructive action of motor vehicles, and the devising of new methods of construction adapted to the requirements of this twentieth century traffic. That the automobile has come to stay no one will dispute. It is estimated that there are already about 250,000 machines owned in the United States, and the number is increasing at a marvelous rate. In France, which is credited with having the most superb system of roads in the world, built at a cost of about $625,000,000, a great International Road Congress was sanctioned by the French government and held at Paris in October, 1908. So alarming were the ravages caused by motor traffic on the costly French road system that the purpose of the meeting was announced to be "The Adaptation of Roads to Modern Methods of Locomotion." In the United States, the problem as yet is a vital one only near the great centers of population, for the reason that but a small percentage of the total mileage of roads is improved, and the motor traffic is largely confined to small areas of country, but it will of necessity become increasingly important with the constantly increasing use of the automobile.

The fact that must give us concern is that the old methods of construction which have stood every test for more than a hundred years are inadequate to meet the conditions of this new form of traffic, and that we are in the midst of a transition period which may eventually revolutionize the science and art of the road builder. The highway engineer of to-day is called upon to ascertain in what way the automobile injures the road, what is the exact cause of the injury, and finally to devise an adequate remedy.

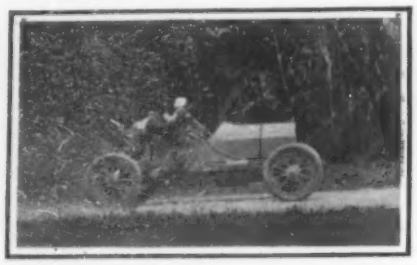
When Trèsaguet, the great French engineer, made his report to the Council of Bridges and Roads in 1775, he set forth the principles of construction which, as modified and added to by John L. MacAdam in the early part of the nineteenth century, have proven adequate until the twentieth century. These great road builders and their successors sought to secure a road capable of withstanding the wear of iron-tired horse-drawn vehicles, for the motor-driven vehicle had no place in their philosophy. They worked upon the theory that the dust abraded from the crushed stone would fill the voids between the angular fragments and when wet would serve as a cement, thereby making the road surface practically a monolith. The iron-shod horses and the iron-tired wheels passing over the road from time to time were depended upon to wear off a sufficient amount of rock dust to replace that carried away by wind and water, and this, under the action of moisture, recemented, thereby automatically renewing the bond of the road surface. When the road was subjected to drought, the conditions were made normal by regular sprinkling. With the advent of the automobile, a totally new condition prevails. The rubber-tired wheels moving at excessive speed fail to produce any new dust from the rock, but the tremendous shearing effect of the driving wheels forces the loose dust on the road into the air in great clouds, and, as the body of the machine displaces a large volume of air, the deflected currents carry the rock dust off the road, thereby effecting a permanent loss of the all-essential binder. It follows that the road is soon stripped of its fine binding material, and the upper or wearing course of the stone is exposed. These stones, robbed of the binding material, are soon loosened by the great shear of the driving wheels, leaving the road badly raveled or disintegrated. It is, of course, apparent that the effects described are greatly intensified on curves where skidding is most frequent.

Highway and mechanical engineers have given much study to the action of the automobile on the road surface, and many ingenious theories have been advanced. While it is true that the slipping of the tire, the skidding, the shape of the car body, and the suction of the pneumatic tires all contribute to produce the effect, the most conclusive experiments seem to warrant the assertion that the great tractive force or shear exerted by the driving wheels of motor cars is the main factor of injury. A series of tests conducted by the United States Office of Public Roads in 1908 produced some interesting results along this line. Cars of various weights and types were run over a measured course at different rates of speed and right-angle photographs taken of each run. A 60-horse-power car stripped for racing, weighing with driver and mechanician about 2,800 pounds, was driven over a stretch of road first at five miles an hour, each run being increased at the rate of five miles an nour until a speed of 60 miles was attained. Up to 20 miles an hour little or no effect was produced on the road, but from 20 miles an hour the effect was striking with each increase in speed. Little or no effect is produced by the front wheels. Practically the entire disturbance of the road is produced by the rear or driving wheels. If the effect were produced by suction or vacuum, the action of both front and rear wheels should be somewhat similar at least. It seems apparent to the writer, therefore, that the road best adapted to motor traffic is the road which will best resist this powerful tractive shear. It has already been demonstrated that no plain macadam road is capable of resisting this force.

While the destruction of the road may be considered as the most tangible and serious problem, the dust nuisance as intensified by motor traffic is most far-reaching in its indirect effects. It has been claimed that nine-tenths of the dust produced by man comes from streets and highways, and someone has very aptly termed the public road the "national dust factory." The effect of the huge clouds of dust upon health must be very great, as most forms of disease are transmitted by this germ-laden dust. The damage to crops growing adjacent to the public highway through the dust nuisance is real and tangible, and particularly is this true of small fruits. So extreme has this condition become in certain districts that no attempt is made to raise fruit near dusty roads. Its effect upon some classes of live stock is most severe, cattle and horses in particular being susceptible to the germs of tuberculosis carried by the dust. The automobile cannot be held responsible for these forms of damage, but it has undoubtedly intensified them. The road builder is, therefore, called upon in many cases to mitigate the dust nuisance by devising a form of treatment which might be considered a palliative.

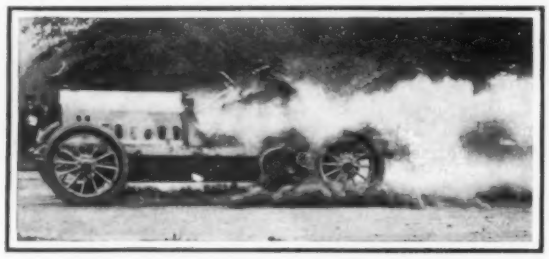
The efforts of progressive highway engineers are directed, therefore, primarily toward the preservation of our stone-surfaced roads and the construction of dustless roads, and secondly to minimizing or mitigating the dust nuisance. The results so far accomplished have been for the most part experimental, and but little attention has been given to the actual composition and characteristics of the materials employed.

It is evident from even the slightest consideration of the subject that the solution of the problem must come, for the most part, from the highway engineer rather than the automobile manufacturer and the legislator. Manufacturers have, to some extent, tried to reduce the dust-raising tendency of their machines by various mechanical devices. Experiments in England brought out the fact that cars fitted with bodies having either very great or very slight clearance raised less dust than those with an average clearance. Some novel devices were tried with more or less success, the



Twenty miles an hour.

Thirty miles an hour.



Eighty miles an hour.

THE DISINTEGRATING EFFECT OF AN AUTOMOBILE TRAVELING ON AN ORDINARY MACADAM ROAD AT DIFFERENT SPEEDS.

SPRINKLING TAR ON A ROAD AT JACKSON, TENN.

WAGON FOR FORCING BINDER INTO A ROAD.

SPREADING TAR WITH BROOMS.

best results being obtained from a car with a flat steel bottom overlapping the sides of the car, and shoes instead of mud guards. The under screen was six inches from the ground and projected beyond the radiator in front to catch deflected wind from the faces of the car and pass it between the screen and the car, instead of between the car and the road. It is an evident fact that the greater the speed the greater the amount of dust, and the greater the damage to the road. Steps have already been taken to combat the speed mania by the enactment of the most stringent speed regulations. Much difficulty is found, however, in enforcing these regulations.

The experiments conducted by highway engineers, particularly in France, England, and the United States, have been directed toward providing a stone-surfaced road with

CONSTRUCTION OF BITUMINOUS MACADAM ROAD BY PENETRATION OR GROUTING METHOD. HEAVY TAR IS APPLIED ON THE TOP COURSE OF STONE.

a binder more powerful than the rock dust. For the purpose of presenting intelligently the experiments thus far conducted with special binders, the term "dust preventives" has been applied to all of the various binders having for their object either the suppression or the prevention of dust. These may be divided into two classes, temporary and permanent. The temporary binders serve merely as palliatives and require frequent renewal; the permanent binders, so called, enter into the structure of the road as a constituent element, and are either incorporated with the other materials at the time of the construction or applied later by a surface treatment.

In the class of temporary binders may be included water, salt solutions, light oils and tars, and oil and tar emulsions, while the

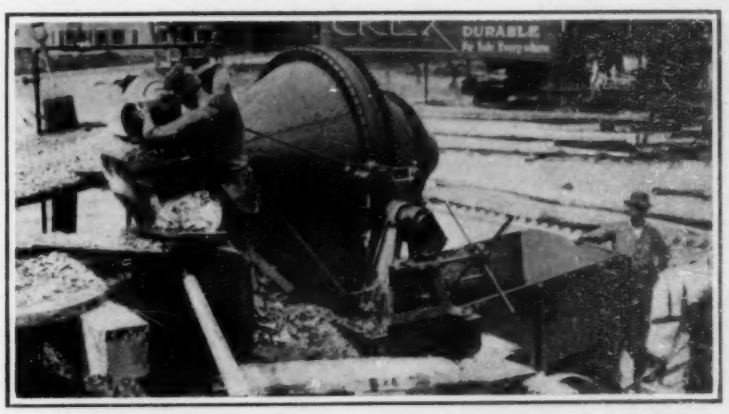
(Continued on page 65.)

MIXING A BATCH OF MATERIAL OFF THE ROAD BY HAND MACHINE.

BITUMINOUS BINDER APPLIED WITH BROOMS FROM STEEL WHEELBARROWS.

TARRED STONE DELIVERED ON THE ROAD ON PREVIOUSLY COATED WORK.

HAND MIXING OF BITUMINOUS BINDER ON THE ROAD.

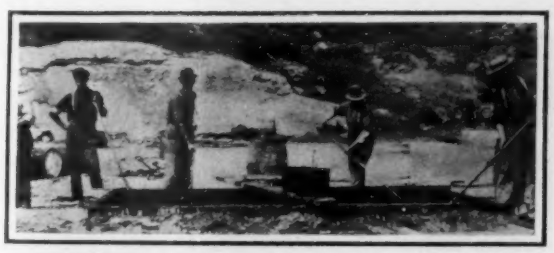


SMITH CONCRETE MIXER USED FOR MIXING ROAD-MAKING MATERIAL.

AN OBJECT LESSON ROAD AT UNIONTOWN, ALA.

APPLYING SPECIAL TAR BINDER AT WESTWOOD, MASS.

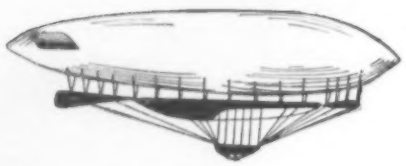
SUBGRADE COURSE BEFORE ROLLING.



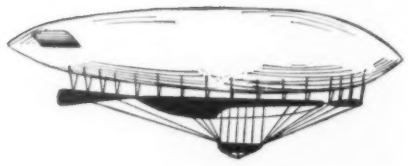
MIXING THE INGREDIENTS OF A "CANDY" ROAD (MOLASSES, ETC.) THE SUGAR OF THE ROAD REFUSES TO COMBINE WITH ANY LIME THAT MAY BE APPLIED.

ROAD IN FAIRMONT PARK, PHILADELPHIA, AFTER BEING SUBJECTED TO SPEEDING AUTOMOBILES.

APPLYING A FINAL COAT OF TAR TO A ROAD BUILT ESPECIALLY FOR HIGH-SPEED AUTOMOBILE TRAFFIC.



MOTOR BALLOON GUNS.



AUTOMOBILE VS. AIRSHIP

It is to their credit that the manufacturers of artillery should so earnestly have grappled with the new problems presented by the development of successful aeroplane and dirigible balloons, and so quickly have designed special ordnance to meet the new form of warfare. The firm which has been most active in this direction is the great Krupp Company, in having brought out several types of gun, capable of firing at the high angles which will be necessary in order to hit the rapidly moving airships and planes of the future. Because of the extreme mobility of the new method of attack from the air, it is obviously necessary that the means adopted to resist it shall be capable of a corresponding mobility. This is especially true where the warfare is likely to be carried on against more or less rapidly moving bodies of troops.

Now the automobile, because of its speed, weight, and strength, is particularly adapted, not only for carrying light automatic guns, but for affording a platform from which they may be fired with a reasonable degree of accuracy. Indeed the artillery motor car, armor-plated, and carrying a gun that is locked firmly to its chassis, is the natural counterpart of the familiar armored train running on the rails of the regular steam railroad. And although the military automobile will be largely restricted to the roads, and will leave them only under exceptional conditions of smooth and fairly level country, the automobile balloon gun will find a field of usefulness in future campaigns whose limits can only be determined by the hard experiences of a regular campaign.

Of the three rapid-fire-gun motor cars herewith shown, one is American and the other two are of German make. One of our illustrations shows a rapid-fire balloon gun, mounted on an armored motor car of 60 horse-power. The latter, in spite of its weight of three and a quarter tons, is capable of making a speed of 45 kilometers per hour and mounting grades of 22 per cent, even when the roads are of poor quality. The gun is also shown mounted on a semi-armored car. This effective weapon has a muzzle energy of 24.8 meter tons, and an extreme range at an angle of 43 degrees of 7,800 meters. At the maximum elevation of the gun, the shell has a maximum height of trajectory of 3,800 meters.

The armoring of the motor cars consists of nickel steel plates, 3 millimeters in thickness, and the gun itself is provided with a special shield capable of a wide arc of aiming. The wheels, also, are covered in with nickel steel plating. The ammunition is carried in a box underneath the back seat, and it will be noted that the front of the car is provided with slits for riflemen.

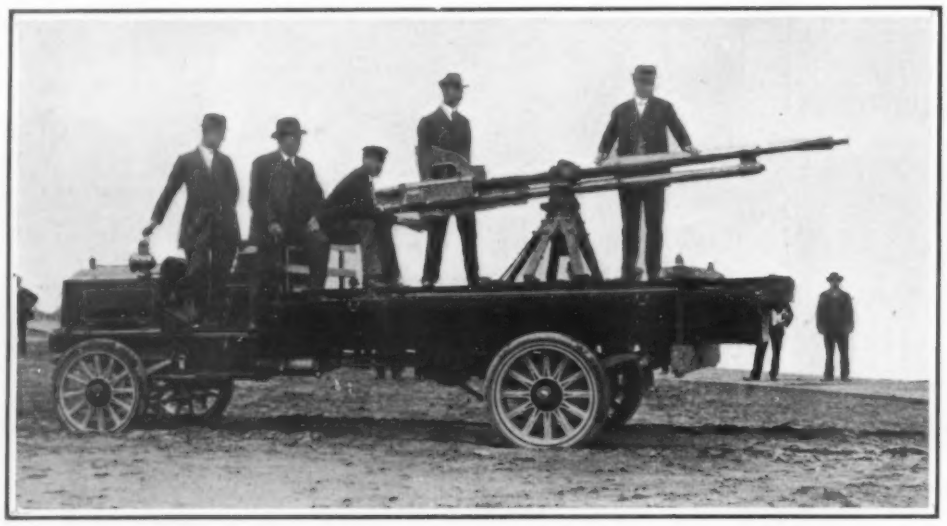
The guns are provided with shells of a special design, suitable for attacking the gas bag of a dirigible or the canvas or rubber-cloth covered surfaces of an aeroplane. To assist in tracing the flight of the shells, they are furnished, at the base, with a smoke-producing substance, which is ignited at the instant of firing the gun, and emits a distinct trail of smoke during the flight of the shell. This gives the gunner some indication of the error in his sighting.

But it will be a very difficult matter to score upon a fast-flying machine speeding mile-high above the earth. The most promising form of attack is with shrapnel, which, if burst at the right distance in front of the object, will envelop it in a perfect spray of jagged shell fragments.

Another illustration shows the McClean-Lissack automatic rapid-fire gun, as mounted on a 3-ton Packard truck, for tests which were carried out last year at Cleveland, Ohio. Lieut.-Col. O. W. Lissack, of the Ordnance Department of the United States army, and Dr. S. W. McClean, designer of the gun, had charge of the tests, being assisted by the Standard Automobile Company, the Cleveland dealer for Packard motor cars and trucks.

The gun fired 3-pound shots at the rate of 100 per minute, the range being 3½ miles. Shots were tried with the brakes of the car set, and also released. When the brakes were set the truck did not move, and no shock was felt by those surrounding the gun on the truck platform. With the brakes released there was a slight movement on the recoil, but no shock. The designer of the gun recommends its use on a truck such as the Packard, but armored for war purposes.

We hope to publish additional information regarding the results of additional trials of this gun, which are being made at Sandy Hook and Springfield for the army, and at Indian Head for the navy.



HEAVY McCLEAN-LISSACK AUTOMATIC GUN MOUNTED ON A PACKARD 3-TON TRUCK.

BALLOON-ATTACK RAPID FIRE GUN, WITH SHIELD, MOUNTED ON COMPLETELY ARMORED CAR. WEIGHT 3¼ TONS.

THE SAME GUN MOUNTED ON A SEMI-ARMORED CAR. NOTE THE SHEET-METAL BODY.

The Middle West and the Automobile Industry.

BY ALFRED REEVES.

Michigan leads all States in motor-car manufacturing, for that State will make 112,000 of the total production of 202,000 cars scheduled for 1910. Four other States adjoining will contribute 70,075 machines. The Middle West may therefore be said to be the real home of the automobile industry. Illinois is scheduled to make 15,300 cars in 1910; Indiana, 21,025 cars; Ohio, 22,750, and Wisconsin, 11,000. In the East, Connecticut will make 2,100 cars; Massachusetts, 4,100 cars; New York, 10,400 cars; Pennsylvania, 3,250 cars, and Rhode Island, 800 cars.

These figures are taken from statistics obtainable in connection with eighty of the prominent automobile companies, and are startling to say the least; both as to their bearing on the location of the motor car industry, and on the importance of the automobile industry as a whole. In addition, it must be remembered that there are fifty other firms making 100 cars or less, with 150 makers turning out a few cars or experimenting.

Just why the middle West should lead in motor-car manufacture is worthy of some consideration, especially when it is remembered that much of the early experimenting in motor cars and early manufacturing was done at plants in Buffalo and Tarrytown, N. Y., Marion, N. J., Bridgeport and Hartford, Conn., Philadelphia, Pa., and other Eastern States.

Because of the tremendous growth of the industry in the past ten years, and the amount of capital and number of people employed, the settlement of an industry like that of automobile making in any particular section of the country, is a condition worthy of thought. The middle West may be said to be in control of the situation, not alone in the making of cars, but in the making of tires, parts, and accessories. For this condition, we must first give credit to the industrial enterprise of the middle West, for the securing of big factories, for the enterprising methods of its boards of trade, and for the readiness to contribute money toward the securing of new industrial enterprises, like that of motor-car building. Next must be considered the labor situation, which is excellent in the middle West, especially in the matter of hands for automatic machinery. Most of the big machinery-making companies are in Ohio or Indiana, where machinists of excellent character are to be had in large numbers.

Besides being the center of the machinery trade, the middle West has been the headquarters for raw material to a very large extent, at least after it has been put through its first or second process, as in the case of rubber, steel, leather, wood, brass, and other things used in the modern motor car.

More important than all is the fact that the middle West is the center for transportation, a most important item when the matter of freight on automobiles is considered. Because of their high value, automobiles contribute very heavily to the railroads, and the matter of freight on incoming material or outgoing cars for an extra thousand miles or so, means an added cost which every manufacturer tries to avoid. While it is true

(*Continued on page 65.*)

ANTI JOY RIDE DEVICES.

BY HARRY WILKIN PERRY.

So great a proportion of the many fatal or otherwise very serious automobile accidents chronicled almost daily during the motoring season is the result of the use of cars without the owners' knowledge or consent, that it seems as if the time has come when the public welfare demands the general equipment of automobiles with some means whereby the unauthorized use of machines can be positively prevented. If matters continue as they have, it will become incumbent on every law-abiding and gentlemanly owner of an automobile to adopt voluntarily such protective measure, even if laws compelling it are not enacted for the public welfare.

"Joy riding"—as the wild running of a motor car by a partially inebriated driver accompanied by several hilarious companions has come to be called in the automobile vernacular—is of several kinds. It may be indulged in by the lawful owner or rightful user of the machine, by skylarkers passing through the streets and finding an unattended automobile standing by the curb which can be appropriated, and by chauffeurs employed by the owner or by employees of the public garage where the car is kept, who take it out, usually at night, without the owner's or the garage proprietor's knowledge.

Laws have existed for some years in a number of States making it a misdemeanor for anyone to meddle with an automobile standing in the street, and prohibiting users of motor cars from leaving their machines unattended with the engine running. During the past winter there has been much activity in legislative circles for the enactment of laws to prevent "joy riding." The New York Legislature passed a bill containing a provision prohibiting anyone from using or tampering with a motor vehicle without the owner's consent, under penalty of a fine, imprisonment, or deprivation of the right to use the public road for six months, or any or all such penalties. The Colorado Legislature passed a bill to go into effect and be enforced immediately upon its passage, as "in the opinion of the General Assembly an emergency exists," prohibiting any person from tampering with or entering or starting any motor car without the knowledge and consent of the owner or owners, whether an individual or a corporation, and fixing the penalties for infraction at a fine of not less than $50 nor more than $300 or imprisonment for not less than 30 days nor more than 90 days or both such fine and imprisonment.

Such laws will doubtless have a deterrent effect, but they are difficult of enforcement and are punitive rather than preventive, applying the punishment after the evil has been committed. The abuse of automobiles as distinguished from their proper and most desirable use has reached such serious proportions as to call for the general application of mechanical and automatic means whereby the unauthorized use of a machine can be positively prevented or detected the first time it occurs and the punishment made to follow swiftly upon its commission.

Inventors have wrestled with this problem for several years, and a variety of devices have been put on the market to fulfill the desired ends. The difficulties in the way of producing a device that will act as a certain check on the use of the car and yet enable the chauffeur or the mechanic to clean and adjust the engine, test the ignition, and generally keep the car "tuned up" to maximum working efficiency, are numerous and complex. Chauffeurs and machinists are clever and resourceful or they are unworthy of their hire. A nail, screw, or piece of wire can be made often to take the place of a removable switch plug, or the star wheel or spur gear that drives the flexible shaft of a recording instrument can be disconnected. Again, if any operating part of the motor car is positively locked against action, such as the wheels, steering gear, or transmission, it may be difficult to move the machine about in the garage, as frequently becomes necessary for washing, repairing, or in event of a fire, when all the cars have to be hurriedly pushed into the street.

Mechanical devices that have been invented with the object of affording partial or complete protection to the owner against the unauthorized use or overspeeding of his car may be divided into groups as follows:

1. Devices to prevent the engine from being started when the car is left standing in the street, embracing (A) ignition switches with removable contact plugs, (B) ignition switches that can be locked in inoperative position.

2. Devices to lock essential operative parts, embracing (A) steering wheel lock, and (B) speed change lever lock.

3. Speed limiting devices, embracing (A) instruments interconnected with a speedometer and the spark or throttle control so that a given speed cannot be exceeded; (B) audible signals sounded automatically when a predetermined speed is attained; and (C) speed indicating devices with large dials prominently placed so that they can be read at a distance by policemen and others.

4. Vehicle movement recording devices, embracing (A) vibration recording instruments of the pedometer type, and (B) clockwork registers in which permanent records of the time, extent and rate of movement are

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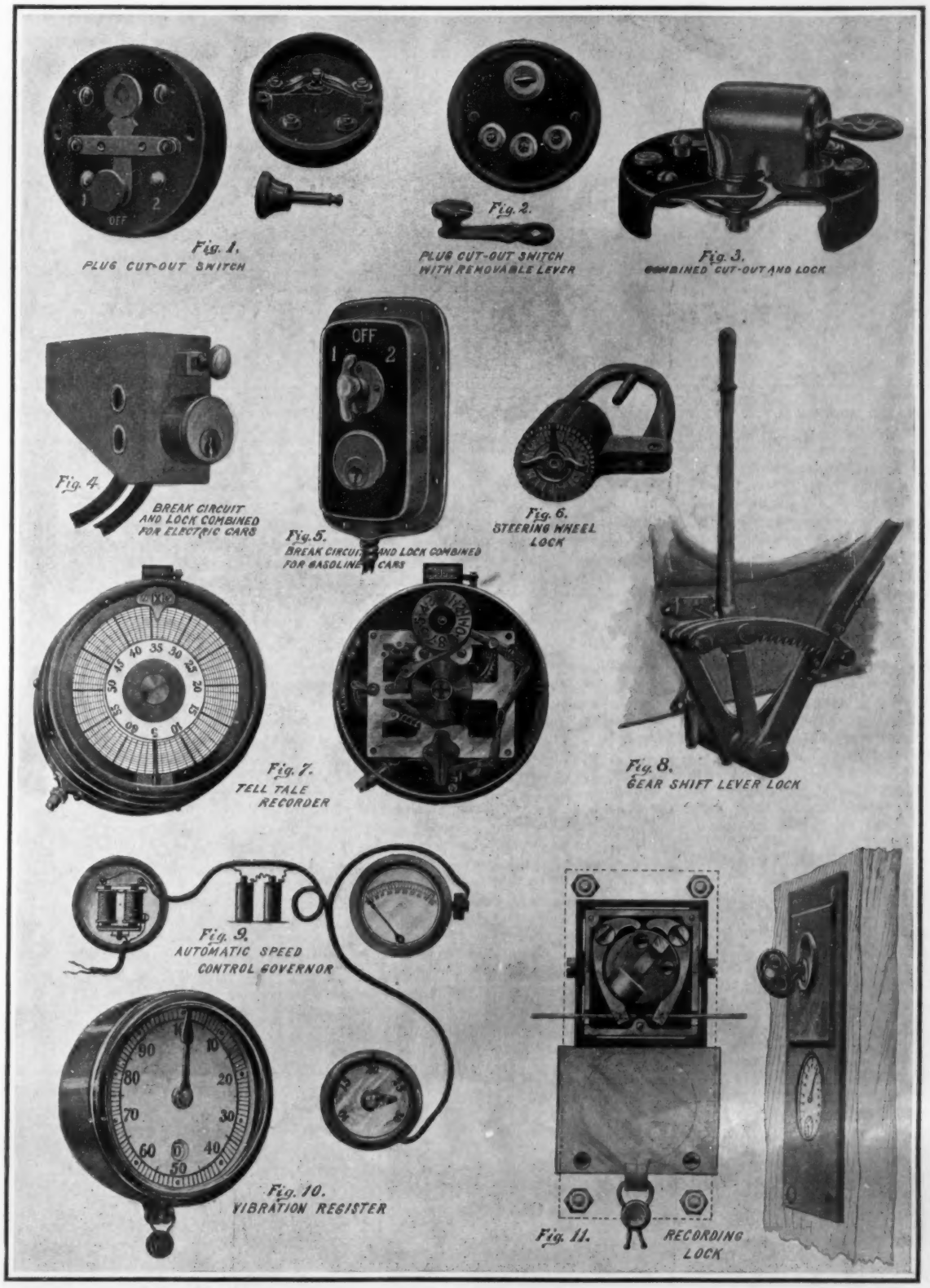


ANTI JOY RIDE DEVICES.

WHAT THE MOTOR VEHICLE IS DOING FOR THE FARMER.

BY WALTER LANGFORD.

Less than five years ago farmers generally looked upon the automobile with bitterness and condemned it as a "toy of the rich." To-day, there are farms comprising hundreds and even thousands of acres, on which nearly all of the heaviest work is done by motor vehicles. There is hardly any part of farm work that cannot be done more quickly and with greater satisfaction by the use of motor power—either applied to a self-moving machine or in the stationary form—than with horseflesh. Whether it is making a quick trip to town with a load of butter, eggs, fruit, or vegetables, to the creamery with the evening's cans of fresh milk, to church with the family on Sabbath morning, doing the spring and fall plowing, cultivating, reaping, threshing—the motor vehicle in its varied forms has become the latest ally of the progressive, prosperous farmer.

M'INTYRE HIGH-WHEELED MOTOR WAGON CARRYING A LOAD OF FARM PRODUCE.

CARRYING CRATED CHICKENS AND EGGS TO MARKET.

It has been a matter of general knowledge and common comment in automobile circles that extraordinary numbers of motor cars have been going into the remote sections of Kansas, Nebraska, Minnesota, the Dakotas, Colorado, and even Montana, Oklahoma, and Texas during the past season. The statement has been made by a man identified with the trade and presumed to be posted that fully one-quarter of the purchases of motor cars west of the Mississippi during the season of 1909 were made by farmers; and this means a good many when the combined output of the manufacturers of the country for the year aggregated in the neighborhood of 75,000 machines. Some of the little communities in the Middle West, with a population numbering only hundreds or at most a few thousand inhabitants, have begun to boast of possessing more motor cars in proportion to population than any other city or town in the country; and to prove it, they congregate all the cars in the village in Main Street and have a group photograph taken.

The farmer, who has long distances to go for everything, from a keg of nails to a paper of tobacco, and who works early and late to make up time lost partly in going "to town," has not been slow to appreciate the luxury and time-saving ability of the motor car. He balances off the cost of a tenth or a twentieth of a gallon of gasoline per mile traveled against a third or half bushel of oats a day at 65 cents a bushel, whether the horse is working or is standing in the stall on a rainy or a winter day, and reckons the time saved to himself as mainly pure gain.

Scattered all the way from the Atlantic to the Pacific coasts there are small fruit and vegetable growers, dairy farmers and poultry raisers who make a daily practice of carrying light loads of produce to market in the tonneau or on the rear deck of ordinary light touring cars. They can leave the horses to work in the field and can make the trip in a third or quarter of the time formerly consumed, thereby gaining just that much additional time to be devoted to more work or to reading, visiting, attendance at concerts, lectures, etc.

The ordinary four or five-passenger touring car of moderate power and reasonable price is most extensively used by farmers. Some of the accompanying illustrations show how such a car is put to practical uses on the farm with the rear seat removed. This is the general utility automobile of the agricultural sections and is used for a great variety of purposes. With it the farmer drives out to his grain field to superintend the threshing, runs down to the pasture with a reel of wire to repair the fence, runs into town with the horses' collars and harness to have them mended, carries cans of milk to the creamery or crates of live poultry to the express office.

Observing the growing demand by farmers for a car for all-around work, a wide-awake automobile manufacturing company in Kenosha, Wis., about two years ago began advertising in the farm papers a double-cylinder light touring car at a moderate price, and inside of a year had sold between 500 and 600 cars in the rural districts. There are now probably between 1,500 and 2,000 of its machines owned by men who live on farms, practically all of whom use them as general utility machines. An easily removable tonneau, high clearance above the road, a thoroughly protected engine and transmission, reasonable price and low fuel consumption and maintenance cost have contributed toward making this model popular with the rural buyers. From the statements of hundreds of users, it is found that the average cost of upkeep is not more than two-thirds that of keeping a horse. The farmer of to-day is well informed regarding the mechanical features that adapt an automobile to his requirements and is a careful buyer. He can safely carry 500 pounds on the rear of a 20-horse-power car and can drive ten miles to town in from half to three-quarters of an hour with the load.

Largely as a result also of the farmers' demands there has been developed during the last three or four years a type of motor car called the high-wheeled buggy. There are upward of fifty companies in the country now actively engaged in building this style of motor car especially for use in country districts where the roads are rough, hilly, and, according to the season, deep with mud, sand, or snow. They are very low in price, simple in construction and operation, and answer the purposes of many rural dwellers very well. They use only about a gallon of gasoline to fifteen or twenty miles traveled, and a set of narrow solid tires, costing say $25, will wear a year or more, with no expense for repair of punctures or blowouts.

Within a year or two there has been added to the two-passenger runabout and four-passenger surrey models a high-wheel open-bed light delivery wagon model, of the democrat wagon type, especially suited to farmers' use. A load of 500 to 800 pounds can be carried in the space beneath and back of the front seat, and in some makes an extra double seat can be set in the back to accommodate extra passengers when the vehicle is to be used as a passenger conveyance.

Other light work wagons with open-bed bodies particularly suited for agricultural uses but fitted with longer bodies and having a load capacity of 1,000 pounds or more and costing $1,000 and upward, are

AN AUTOMOBILE TRACTION ENGINE USED FOR DRIVING A THRESHING MACHINE.

A HOLSMAN HIGH-WHEELED FARM WAGON ON THE ROAD.

TYPES OF AGRICULTURAL AUTOMOBILES.

manufactured by several companies in Chicago, Syracuse, Elgin, Ill.; Dowagiac, Mich., and Lititz, Pa. They are excellently suited to carrying to market good-sized loads of vegetables, fruit, dairy and barnyard produce weighing from 1,000 to 2,000 pounds, and for hauling back loads of feed, fertilizer, fencing and building materials, farm machinery, and so on. The high wheels give the axles and driving mechanism a good road clearance, and the construction is of a heavy and durable as well as simple character.

Numerous cases might be given of motor cars put to special service in connection with farming. In Maryland there is a high-class dairy farm where motor delivery wagons are used altogether to distribute milk among the consumers in the vicinity, and in Indianapolis a large milk company is using a 1½-ton and a 3-ton gasoline truck in the collection of milk from dairy farms within a radius of twenty-five miles of the city, which was formerly shipped by the interurban electric railways or by horse and wagon. In England a large produce grower sends his fresh vegetables to market in a huge motor van, the roof and tailboard of which, as well as the inside, are piled with green goods. These examples seem to foreshadow the time, not very distant, perhaps, when farmers will find it cheaper and more convenient to ship all of their farm products to market on motor trucks than to haul them with horses and wagons. Possibly the trucks will be owned by local express companies organized for the purpose, which will charge a reasonable price for haulage, so that it will pay the farmer better to keep his horses—if he needs any then—at work in the field, and he will not need to invest any capital in the motor trucks. Doubtless some of the transporting companies will use motor tractors, which will run over regular routes every morning and pick up a string of farm wagons loaded with produce, hauling them to market and back again for a fixed charge. A single tractor should be able to haul four or five such wagons over good roads.

In Connecticut a three-ton truck is regularly used for hauling grain and carrying all sorts of farm supplies and products for a 1,300-acre farm. This is one of the many fancy estates conducted in the East by wealthy owners largely as a personal hobby, yet at the same time as a profitable investment. The truck represents an outlay of $5,000 and is kept in a special garage for work motor vehicles which are to be used extensively on the farm.

A ranch of several thousand acres in Montana is conducted entirely without horses, the plowing, sowing, cultivating, reaping, threshing, and hauling of the grain to the railroad being done by motor tractors and motor wagons. We have had the horseless street car for twenty years, the "horseless carriage" for ten, and now we have the horseless farm. May we hope some day for the horseless city?

While the foregoing examples are isolated cases and apply to farming on an extensive scale with ample capital, they point to great possibilities for the future use of self-propelled vehicles in farm work, utilizing gasoline, kerosene, or denatured alcohol as fuel. The farmer with a small acreage who would not be justified in buying a motor tractor for his own use, will be able to hire his plowing and threshing done by companies operating motor tractors, as for many years he has had his threshing done by itinerant steam threshing outfits. And, incidentally, the work will be done cheaper, there will be no danger of fire from flying sparks, there will be little or no water to haul, and there will be fewer men to feed.

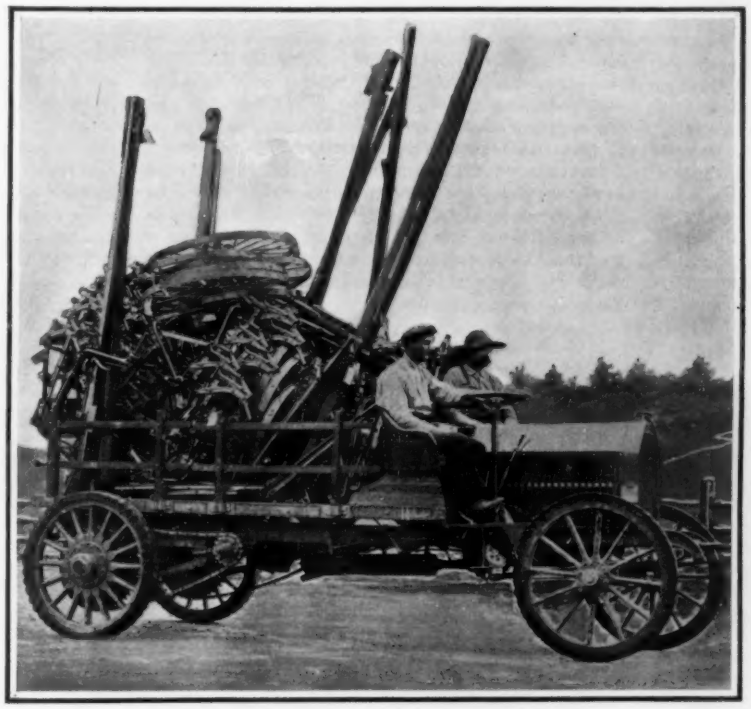
In this country, as well as in England and France, there are large companies that make a specialty of building small farm tractors for universal tractive and stationary power work. A company in Minneapolis makes an 8-horse-power tractor weighing 5,500 pounds for such work as operating hay presses, corn shellers, etc., and for drawing wagons and portable machines of this class on the road. In York, Pa., is another large company that makes motor tractors and traction engines in ten sizes, from 1,000 to 36,000 pounds in weight. The smallest is rated at 1½ to 2 horse-power and is intended for all sorts of farm work, such as hauling the stone-boat, churning, pumping, feed cutting, etc.

American motor tractors used for plowing and threshing usually develop from 12 to 35 horse-power and weigh from 5,000 to 20,000 pounds. They haul gang plows turning from two to eight furrows at a time. One of these—a 15-horse-power tractor built by the largest harvesting machinery company in the world—plowed 1.09 acres of "gumbo" soil with a three-furrow, 12-inch bottom plow in an hour and a quarter on a consumption of 1½ gallons of gasoline per acre at an international competition held in Winnipeg last July.

A "wagon tractor," built in Peoria by a great agricultural implement works for general utility purposes in the field and on the road, was tested at the same trials. Coupled to a two-furrow 14-inch gang plow, it turned over 1.06 acres in 1 hour 25 minutes on a consumption equivalent to 3.36 gallons of gasoline per acre. This would amount to about 50 cents an acre for fuel. In a ten-hour day 7½ acres could be plowed for about $3.25, not including labor.

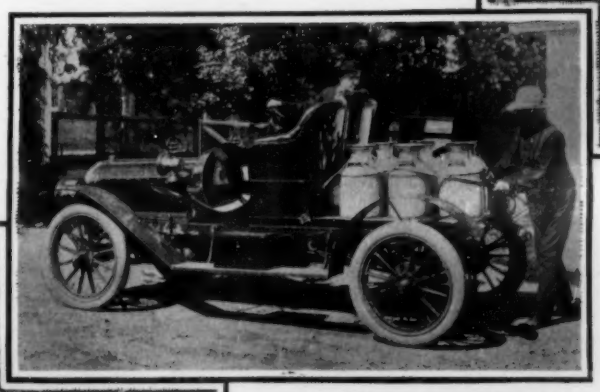
This wagon tractor is a very interesting vehicle. It was designed particularly for farm purposes by men who are familiar with the peculiar requirements, and combines in one machine a truck for carrying loads on its own body, a tractor for drawing plows and other farm machinery, and a power plant for driving threshing machines, hay balers and other stationary machinery by belt. It will take the place of several teams and wagons on the farm.

Nowadays, on the farm as well as in the manufactory, it is necessary to do the largest amount of work in the shortest time in order to make an undertaking successful. This is recognized by the progressive farmer and farm machinery builders, and to a large extent the advantages of the motor car and motor tractor are appreciated by builders of farm wagons and buggies. Most of the leaders in these fields are now offering their customers a motor buggy, a motor car, a motor wagon, or a motor tractor.



AN AVERY FARM TRUCK HAULING SCRAP.

INTERNATIONAL HARVESTER FARMER'S WAGON.



HALF A DOZEN CANS OF MILK ARE TAKEN TO THE CREAMERY AND THE EMPTY CANS BROUGHT BACK.

WITH A REEL OF WIRE FENCING AND A BOX OF TOOLS ON THE REAR DECK THE PASTURE FENCE IS QUICKLY REPAIRED.

The Modern Electric Automobile.

BY EMIL GRUENFELDT, M.E., E.E.

The heavy, cumbersome electric cab or brougham of earlier days has cleared the field for the light runabout, victoria, or interior-driven coupé. Less weight means more speed and a greater mileage radius. It was looked upon as a great performance when one of the earlier types of electric automobiles traveled forty miles on a single charge of the battery at a comparatively low speed. The modern electric automobile will negotiate about twice the distance at a much greater speed. The most vital components of an electric automobile are the motor and controller, two parts which are of different design on about every other make. For its various advantages, the series-wound motor has outclassed its rival of the earlier days, the compound motor. The series-wound motor, if properly designed, will do its work for three hundred and sixty-five days in the year without requiring any attention. The most desirable motor is not that which tends to drive a car up a hill at a comparatively high speed. A heavy battery discharge is thus entailed, which is of course very detrimental to the battery. Of two cars traveling at the same speed on the level, that one will travel the faster on a grade, whose controller was not changed. The motor of this faster car is designed for a smaller increase of torque in proportion to the decrease of the speed. Even if this difference in speed is very small, say one-half mile an hour, the faster car will have to pay dearly for it, in current as well as in decrease of mileage radius and in battery wear. The good designer will find a middle way. He will strive for the highest battery efficiency. It is by no means difficult to construct a fast electric, as the power is unlimited for a short distance. The art is to apply the power at disposal in the most all-around satisfactory way, and to design a carriage which is reliable and cheap to maintain.

In the line of various controllers, the drum type for good reasons seems to have grown into great favor. The various speed changes can be obtained without arcing or burning, and a gradual increase of speed is effected from step to step with a small increase of

(*Continued on page 66.*)

THE MODERN LOW-PRICED CAR.

BY JOSEPH ROGERS.

The automobile buyer faces no such questions in 1910 as confronted him a few years ago, when all that was expected of a car was that it would run. At that time the gasoline engine was not understood as the engineer understands it to-day, and all of the parts and appurtenances were undergoing a process of evolution that resulted in vast differences between the models of two successive years. Each make had some peculiarity of design, and the selection of a car was complicated by the difficulty of getting definite information on performance.

There were reliable cars, of course, but their initial cost and the expense of operation made their ownership possible only to the very well-to-do. The car that could be bought by the man of moderate income required close attention, and the adjustments and repairs that were a constant necessity left him little time for anything else. If these were in the hands of a repair man, the monthly bills were out of all proportion to the mileage covered and the pleasure obtained. Automobiling at that time was unquestionably a diversion for the rich, and it is popularly supposed that such is still the case; but as a matter of fact, the man of moderate income can to-day purchase and use a car at an expense that is well within the bounds of reason.

The primary cause for this is found in the relatively close understanding of engine and car design that obtains to-day. The systematic experimental work that has been carried on in the large factories has resulted in a refinement in design and an approach to a standard that place automobile manufacturing on as economical a basis as is possible in the production of any other mechanism.

The moderate price at which an automobile may be bought is not due to the use of poor material and cheap labor; on the contrary, the low-priced car of to-day is better in quality than the highest grade cars of six years ago.

In the early days of the automobile industry, the manufacturer was under the necessity of making all of the parts; to-day, the factories actually making even 75 per cent of the parts that they use are in small proportion to the number of producers. A few years ago, when a manufacturer purchased his engines, change speed gears, or other parts, he concealed the fact; to-day, a constantly increasing number of firms make it no secret that their cars are assembled in whole or in part. It is to these changes in policy that the excellence of the medium-priced automobile is largely due.

The manufacturer of a complete car is under the necessity of maintaining an experimental department in which he can try out suggested improvements on all parts of the chassis. This is expensive work, and a proportion of the cost of the department must be included in the price of every car sold. The maker of an assembled car is under no such handicap, for each of the firms with which he does business will carry on only such experimental work as is required for its special line, and the expense is borne by so great an output that the individual proportion is negligible.

There was a time when an assembled car was undoubtedly open to suspicion, for however desirous the makers of its parts might be to do good work they had neither the knowledge nor the facilities that would make it possible. These same companies now possess enormous plants, their designers and equipment are the best obtainable, and their products embody the latest and best in practice, material and workmanship. Assemblers thus have parts at their command that are of a high degree of excellence, and can buy them at prices that are far below what was charged for the weak and faulty product of former years.

The low prices at which assembled cars can profitably be sold have forced the builders of cars of competing grades to manufacture on a very large scale, in order to bring down costs through economies possible only with quantity production. Such a firm equips its factory with jigs and special tools for every operation, and makes it an inviolable rule to accept no order that calls for even a slight deviation from the standard specifications.

When a manufacturer turns out twenty thousand cars a year, it is not only justifiable but necessary for him to invest very considerable sums in special machinery of all kinds that for a smaller output would be inadvisable. One manufacturer has spent $40,000 for dies to produce a rear axle housing; on a production of one thousand cars, the charge against each for this would be $40. With an output of twenty thousand cars, however, the charge of $2 against each is little enough for the purchaser to pay for so excellent a feature.

A recent development that illustrates the endeavor to reduce manufacturing costs is the establishment by some of the leading producers of assembling shops at the large centers. To these are shipped parts in sufficient quantity to build the cars required for that locality, and as there is no equipment of machine tools, the expense is slight. The freight rate on unassembled parts is much lower than on complete cars, and the saving effected in time and convenience as well as in money makes the system a satisfactory one.

However it may have been in the past, the present-day manufacturer of moderate-priced cars makes no more than a legitimate profit. One of the largest producers stated recently that his profit on a $1,000 car is less than $100; this is not excessive when one considers his enormous investment in material and parts, his really vast equipment of machine tools, and his labor expense.

It has been said that any average engineer can design a car to sell at $4,000, but that the greatest skill is necessary when the selling price is to be less than $1,000. However that may be, the medium and low-priced cars on the market show exceedingly clever designing, and bear every indication of the highest grade of mechanical engineering. Being light in weight, the material entering into their construction is selected with the greatest care, and it is typical of the automobile industry that many of the alloy steels in common use were hardly more than laboratory curiosities five years ago.

The whole tendency of design is to reduce weight and machinery and assembling costs, but it is rare to see a case where strength and durability have been sacrificed for economy. One of the features of the 1910 cars is the casting of the four cylinders in one piece, which results in a considerable saving in weight and cost, with no apparent reduction in strength or ability. The increasing tendency to adopt the gravity system of water circulation is another economical move, for it permits the suppression of the pump. The mechanical lubricators that were formerly in general use have been abandoned in favor of a single pump located in the crank case, which is not only less expensive to build and assemble, but makes lubrication as positive and unfailing as it well can be. The magneto is now the standard equipment even for cars of very low price; and quite frequently it is the sole means of ignition. An advantage that may be gained through its use is that the spark may be maintained at a fixed point, and therefore the spark control lever and its connections may be done away with. The locating of the clutch and brake pedals on the gear case reduces the cost of assembling, for when they are hung on a rod passing across the frame, as was the practice in former years, accurate fitting is an absolute and costly necessity. When the engine, change speed gear and rear axle are separate units, assembling is complicated by the necessity for setting them accurately in line; in a great number of 1910 cars the change speed gear is either built in with the engine or the rear axle, and the cost of assembling is reduced in consequence.

In spite of the excellence of the 1910 cars, it must not be assumed that the limit of perfection has been reached. Some of the work turned out by the designers shows that they have followed a common path, but in many cases there are differences that are not easy to reconcile. The perfected car cannot come until the efficiency of one definite construction has been recognized, and its proper proportions demonstrated. The great variance in the designs of to-day is evidence in itself that there is still much to learn, for otherwise, as an example, there would be less difference in the dimensions of engine bearings than is now noticeable in different makes of engines of the same power. The relation of bore to stroke is the subject of a vast difference of opinion at the present time, and even the relative length of the connecting rod is by no means fixed.

Having produced cars that will run, and that can be depended on for steady service, the problems now before the designer have to do with the increase of efficiency and economy of operation. At the present time it is doubtful if any manufacturer knows what proportion of the power of his engine is absorbed in operating the valves, or in driving the magneto and pump, but these and other far more complicated details must be worked out in his future models.

If the principles of the present engine are adhered to, the coming years will bring a closer and more accurate knowledge of the cycle, and a general adoption of the features and relative dimensions that survive the ordeal of usage. For the car owner this will mean greater economy in the use of fuel, increased simplicity in construction, and the reduction in price that is the invariable result of standardization.

The Wright Suit and Aviation in America.

The granting last week by Judge Hazel of a preliminary injunction restraining Glenn Curtiss and the Herring-Curtiss Company from making, selling, or flying their well-known type of biplane has quite taken by surprise almost everyone versed in patent law, as such an injunction has been granted very rarely, if ever, before upon an unadjudicated patent. Even in the case of the Selden patent covering the use of a clutch between the motor and the road wheels of an automobile—a case in which an infringement was much more apparent—such an injunction was not granted. The granting of the injunction at this time has had two results. In the first place it has intimidated a good many inventors who were hard at work upon the perfecting of the aeroplane, and secondly it has encouraged the Wrights to attempt the creation of a monopoly in flying machines. With a million-dollar company back of them, and with orders already booked aggregating more than this figure, the granting of the present injunction gives them practical control of aviation in America. A second step in this direction occurred on January 4th, when aviator Paulhan was served with a notice to appear in the New York District Court ten days later to show cause why he should not be enjoined from flying his Farman biplanes in the United States. As he is booked to make flights at the Los Angeles aviation meeting from the 10th to the 20th, this action may be a serious blow to the first aviation meet held in this country.

The death of Leon Delagrange from a fall sustained as a result of the breaking of a wing of his Bleriot monoplane while flying in a 20-mile wind at Pau, France, on the 4th inst., has given aviation another setback that it will take a long time and many excellent demonstrations to overcome. Four lives lost within the last four months is a record by no means encouraging to sportsmen, and unless everything possible is done to encourage flight in this country, none of the aeroplane factories soon to be started will do much business for some time to come.

Hydrogen for Inflating Pneumatic Tires.

The inflation of an automobile tire with a hand pump is so laborious an operation that some automobilists carry cylinders of compressed air, with which a tire can be inflated easily and rapidly. The cylinders, however, may be found empty when they are most needed. Drouctly, a French manufacturer of aluminium paper, has conceived the idea of replacing the air by hydrogen, generated by the action of water on specially prepared aluminium waste. In presence of alkalies, aluminium decomposes water into oxygen and hydrogen. The oxygen combines with the aluminium, and the hydrogen is set free. The method of operation is very simple. About 10 ounces of granulated aluminium and 10 ounces of water are introduced into an air tube of the capacity (6½ pints) which is commonly furnished by the great tire makers, and the bronze plug is quickly screwed down. In a few seconds the space not otherwise occupied, about 5½ pints, is filled with hydrogen at a pressure of 150 atmospheres. This is equivalent to more than 100 gallons of hydrogen at atmospheric pressure. The other product of the reaction is alumina, which can easily be washed out. The special preparation of the aluminium consists in the addition of a small percentage of mercury bichloride which starts the reaction in the absence of alkalies so that pure water can be employed.

This method possesses two advantages. It allows every automobilist to recharge his air tubes without returning them to the factory. There is also a real advantage in inflating tires with hydrogen instead of air. The diffusion of gases through colloidal substances like India rubber follows a very different law from that which governs the diffusion of gases through porous walls. In the latter case the rate of diffusion is inversely proportional to the square root of the density of the gas, but the rate of diffusion through India rubber is directly proportional to the facility with which the gas can be liquefied. Hydrogen generated by the action of aluminium upon water was used for filling balloons in the Russo-Japanese war, but this ingenious and simple method of obtaining cylinders of compressed hydrogen appears to be as new as it is interesting.

To Americans who are accustomed to five-cent car fares, it will be surprising to learn, on the authority of The Engineer, of London, that last month there was inaugurated an electric-car service from one of the London subway (tube) stations to the suburb of North Finchley, on which a fare of half a cent will be charged.

HOW TO OVERHAUL A CAR.

BY HERBERT L. TOWLE.

In order of importance, the facilities needed for overhauling are a warm, light place to work, an extension electric light, a bench, several boxes for use as receptacles and supports for the dismantled parts, and as liberal an assortment of tools as the owner's means will permit. An iron vise, a bench drill, a foot or power lathe for metal work, and an emery wheel are almost necessary. Failing these, certain parts can be sent to the shop for refitting. A complete kit of bench tools is assumed—hammers, files, hack saw, chisels, wrenchs, screwdrivers, cotter pin extractor, etc.; also a soldering torch.

The first step after washing the car is to strip it of lamps, mud guards, and small gear generally. If the screws and nuts are greasy drop them into a pan of kerosene. Have a large box handy for small parts, and three or four small boxes in it for the purpose of grouping related small parts together. It is very easy to get a car apart and shuffle the various bolts, washers, and other small things so thoroughly that it is impossible to tell where they belong on reassembling.

Ascertain by looking underneath whether the gasoline tank is attached to the body or to the chassis. If the former, disconnect the gasoline pipe at both ends, plug the ends with bits of rag, disconnect the horn tube and any electric wiring that may run from the body to the chassis, take out the bolts holding the body to the side and rear frame members, and lift the body straight up. The dash is a part of the chassis, not of the body, and does not need to be disturbed at this stage. Have a couple of wood horses ready to receive the body. Do not set it on the floor, as there may be parts projecting beneath it such as the gasoline connection beneath the tank.

The amateur is advised to begin overhauling in the order of ease rather than of magnitude. For this reason the brakes are suggested as a start. Inclosed rear brakes on a car with side chains are generally exposed by taking off the rear wheels. First see if the brake drums have removable cover plates. If not, take off the sprocket chains, unscrew the hub caps and nuts, and the rear wheels will come off, leaving the expanding brake shoes in place and exposed. Note whether or not the adjustment is near its limit. If so, replace the shoes. The foot brakes are adjusted or relined in the same way.

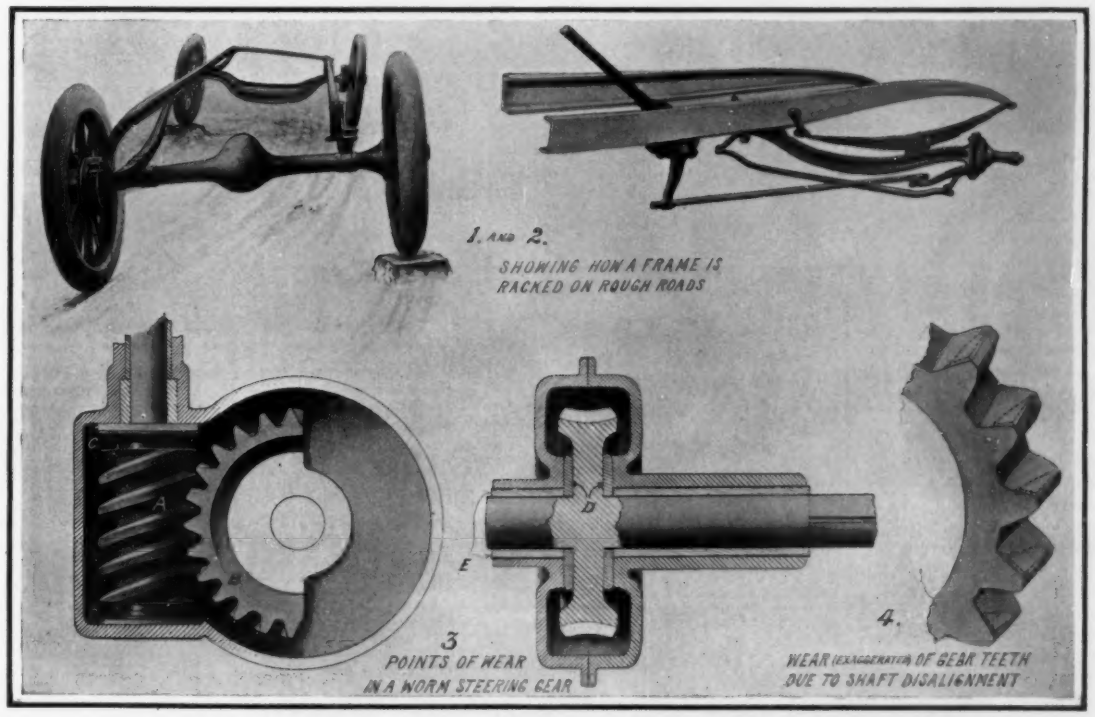
Remove the radiator, wash it out under a strong stream of water, and if it is suspected of being encrusted with scale fill it up with kerosene and let it stand—until spring time will do no harm. When reassembling it is important to give the radiator an even bearing around all four studs, supposing it to be held down by that number. If possible, have it rest on ⅛-inch sheets of rubber, and do not draw the holding-down bolts entirely tight. The radiator, although frail, is much more rigid than the frame, and any springing of the latter will surely start leaks in the radiator if it has to follow it. The two sketches, Figs. 1 and 2, show how a frame may be racked in going over a rough road. If the radiator leaks it is best to let an expert tinsmith repair it (not all tinsmiths are expert). The secret of success is to use a good grade of solder and sweat it thoroughly into the seams, taking plenty of time. If the top is not steadied it will be worth while to run a brace or stay rod to it from the top of the engine or the dashboard. This rod need be only heavy enough to check the vibration.

If there is much lost motion in the worm or other reducing gear of the steering mechanism, disconnect the steering links, also the throttle and spark connections, and take the steering column out with the reducing gear at its base. Open the casing and see where the lost motion is. It may be in the threads of the worm *A*, Fig. 3, and the teeth of the segment *B*. Much of it, however, is likely to be in the thrust washers *C C* of the steering column, and *D* of the segment shaft. Frequently ball bearings are used at *C C*. In time either these or plain washers need replacement, likewise the bushings *E E*. If the steering gear case is not provided with a grease cup, this is an excellent time to put one in. Wear on the worm and segment *A B* is not easy to take up; an approximate cure is to make the bushings *E* eccentric, so that by turning them the centers of the worm and segment are brought closer together. Since, however, most of the wear is in the middle teeth, the gear may be loose in the middle position and tight when the wheels are cramped over. There is no remedy for this, save renewal.

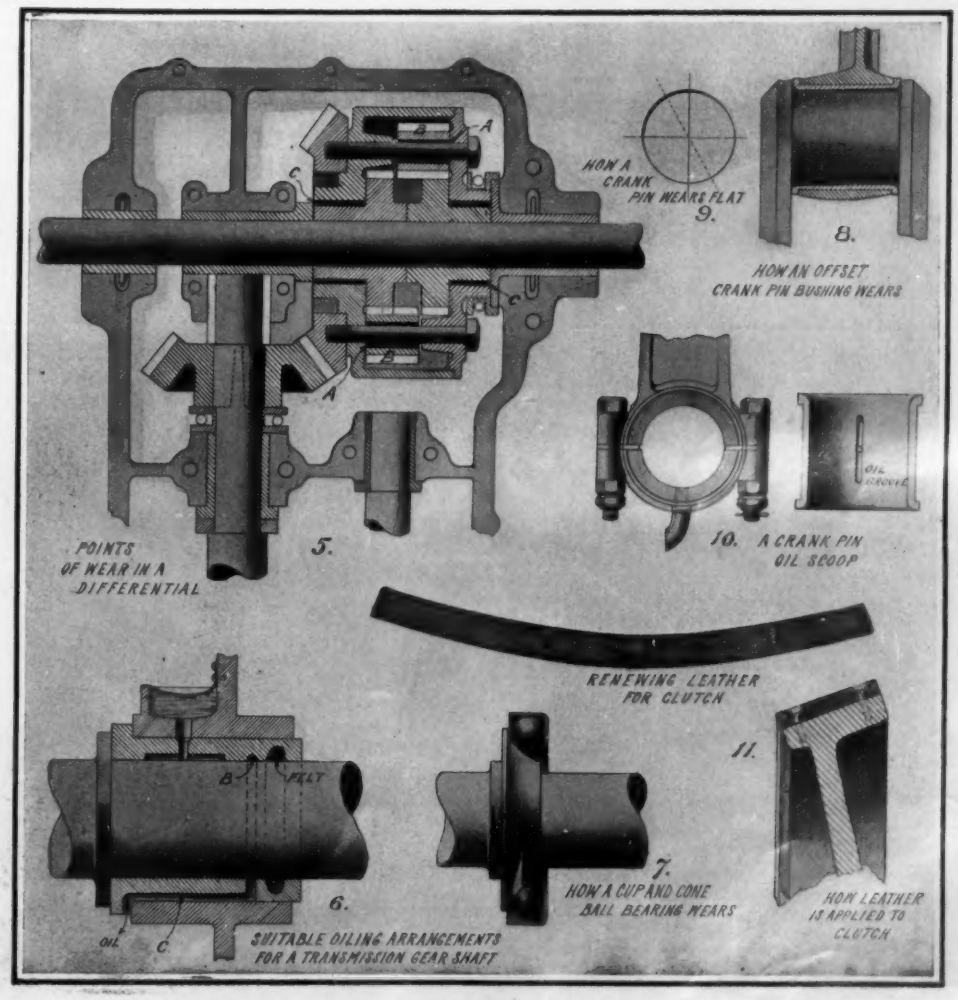
The steering knuckle pivots and the pins in the ends of the cross link wear loose in time, and usually it is a shop job to ream the holes and fit new case-hardened pins. See that the front wheels are parallel or "toe in" very slightly when pointing ahead. It is usual to shape the steering knuckles so that the wheels incline toward each other at the ground. They are rarely vertical, and never incline the other way. If the front axle is sprung, have a blacksmith straighten it.

Clean out gear case and test all the bushings, including the pilot bushing at the front end of the squared shaft, by shaking them. If ball or roller bearings are used, replace them if loose; if plain bushings, they must be refitted or replaced. New bushings bought from stock generally need considerable fitting. The rea-

(Continued on page 68.)


1. AND 2.
SHOWING HOW A FRAME IS RACKED ON ROUGH ROADS
3
POINTS OF WEAR IN A WORM STEERING GEAR
4.
WEAR (EXAGGERATED) OF GEAR TEETH DUE TO SHAFT DISALIGNMENT

SOME PARTS OF A CAR WHICH MUST BE CAREFULLY CONSIDERED IN OVERHAULING.

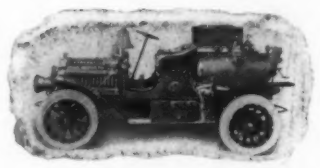


HOW PARTS WEAR IN AN AUTOMOBILE.

AUTOMOBILE FIRE ENGINES.

A NEW TYPE OF MOTOR VEHICLE.

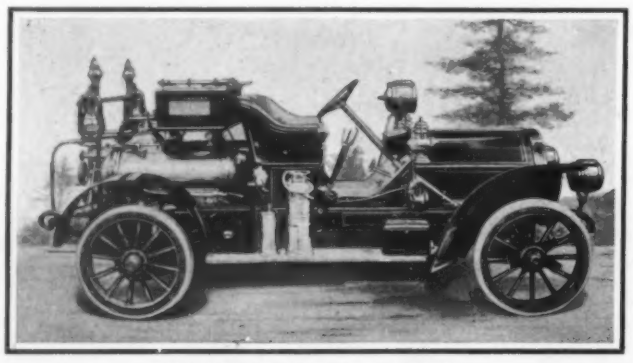
BY HERBERT T. WADE.



The great success of automobile fire apparatus in Europe and in many of the smaller cities of the United States frequently gives rise to the inquiry, why are such machines not used more extensively in the larger fire departments, where the highest efficiency of apparatus and personnel is demanded and maintained? The acknowledged utility of automobiles for pleasure and business, even under extraordinary conditions, emphasizes this tardiness the more forcibly, particularly as the modern motor vehicle is now capable not only of attaining high speed but of carrying heavy loads. Promptness in reaching a fire with suitable apparatus is of prime importance, and the automobile in this respect and in endurance is easily superior to a horse. To-day with high speeds pumping capacity can be secured in a motor vehicle sufficient for most conditions of service, and this, with economy of maintenance after the initial cost, has led to the adoption of automobile fire apparatus by many of the progressive smaller cities. This economy is obviously due to the fact that only when in operation are gasoline and oil required. A horse even when idle entails expense for shoeing and feeding.

Even the most conservative of metropolitan fire officials realize that the rapid transportation by horses and the subsequent operation at high pressure of a heavy steam pumping engine on wheels is more or less a mechanical anachronism in these days, when central power stations have largely taken the place of the small isolated plant, and when small internal-combustion motors using gasoline have been found economical, convenient, and efficient. The pumping power of a fire engine depends upon the weight that can be transported. As an internal-combustion motor connected with a pump would weigh much less than a steam engine and boiler and going to a fire would use the same engine for propulsion, it would follow that greater efficiency could be secured. Even superior from the mechanical standpoint, but not as yet practically applied, would be the mounting of an electric pump on a gasoline-driven motor car, using current derived from supply mains near the scene of operation. Chief Binns of the New York Fire Department has developed such an idea which possesses many obvious merits. He proposes to use electrically-driven centrifugal pumps on motor vehicles capable of high speed and to obtain power from electric-light standards or other outlets which are at almost every street corner and quite as well distributed as hydrants. The same condition also prevails in many rural districts, where electric light and trolley lines are to be found on every main street. Suitable plugs and conductors could be used for connections, and with the power derived from a central station the portable machinery would be reduced to a minimum weight. A similar idea, though not so elaborately developed, was put into operation more than twenty years ago by Dr. S. S. Wheeler, now president of the Crocker-Wheeler Company, Ampere, N. J. This apparatus consisted of a bipolar motor directly coupled to a pump, and was mounted on a light carriage. The gasoline motor car was not so highly developed at this time, for which reason the carriage was drawn by horses. A fire engine built on this plan was tried out on the Erie Canal at Schenectady. It was finally brought to Ampere, and was destroyed in a fire which occurred there in 1895. Strange to say, this scheme, which would involve comparatively little outlay for a large city, has never been thoroughly and practically tested.

At present, motor apparatus is most widely used in suburbs and small cities with wooden dwellings; in other words, in communities where its high speed renders it possible to cover a much greater territory by a single company, and where infrequent alarms reduce the expense of maintenance far below that entailed for feeding and shoeing horses. For example, a St. Louis motor company recently made a run of nine miles to a country villa outside the city limits and arrived in time to save the house. This same company in a period of eighteen months responded to 1,000 fires without a single failure, and in so doing traveled 2,250 miles in all conditions of weather, including mud, sleet, and snow. The economy of this company is apparent from the fact that its maintenance account for twelve months was $481.31, including two accidents, which resulted in an expense of $250, as compared with an annual cost of $816, for feeding and shoeing two horses. Even in a district where there are no water supply hydrants, such a machine can make a speedy run, and draw water from a well, canal, or pond.



MOTOR-DRIVEN CHEMICAL ENGINE.

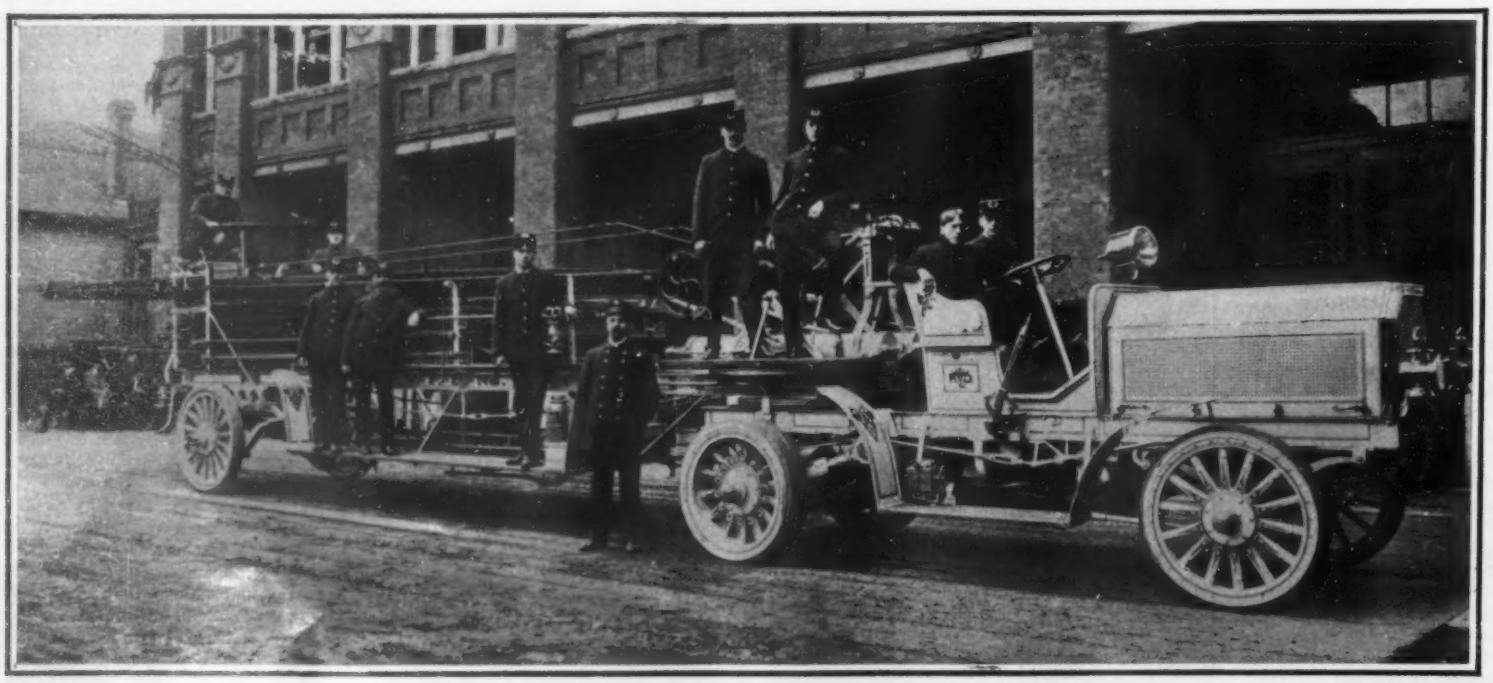
In a large city the question of territory is not as important as that of speed in getting the firemen to the fire. In a district with high-pressure fire protection fires occur which taken in time may not require the powerful streams from the fire hydrants and could be put out with a minimum of water damage. Indeed it seems likely that the future fire protection of a large city will consist simply of an efficient high-pressure water system and automobile engines and hose wagons.

In a description of modern automobile fire apparatus we may mention, first, the high-speed touring car or runabout, for the use of chiefs and supervising officials, capable of rapid travel and of covering wide sections of territory. This was the first automobile used by fire departments. Such a car does not usually carry extinguishers or any fire apparatus, one or two small extinguishers and axes or other tools being added only in rare instances. All that is demanded for such a machine is a high quality and reliable motor car of sufficient speed and easy control. In hardly more than thirty minutes Chief Croker of the New York fire department is at the scene of any fire in Greater New York, directing in person the operations of the firemen. This is significant in view of the large amount of territory comprising the greater city and the dangers involved in some of the outlying districts.

A modification of the chief's car may be seen in that supplied to the battalion chief or the head of the fire department of the smaller city. Extinguishers and tools are often considered essential. The chief carries with him not only a chauffeur but one or two firemen from the permanent headquarters force.

If rapid travel is desirable for the chief, it is of course equally advantageous for the firemen responding to an alarm. In small blazes such as those caused by a curtain blowing against an open gas light or by a short-circuit of a lighting system, one or two men with axes and hooks promptly on the scene can prevent what might be a serious fire in a dwelling house or stable. Accordingly it was early realized that auxiliary or emergency squads could be equipped with motor cars and could be dispatched at high speed to the scene of the fire. These men deal with an incipient fire or prepare for the steam engines which follow and if necessary send in additional alarms or communicate by telephone with headquarters. This type of equipment is extensively used throughout the United States.

But it must be realized that this means simply the prompt bringing to the scene of action the trained men who can take care of the smallest kind of a fire. Without apparatus or sufficient power nothing can be done where the blaze is at all serious. It was with this end in view that automobile fire-fighting facilities were increased by adding a chemical tank and a few hundred feet of small hose. The chemical tank and equipment has now become an indispensable feature of many fire departments. Carried on horse-drawn hose wagon, a small fire can be quenched in its incipiency by its means with a minimum use of water and consequent damage. The chemical tank consists of a copper cistern of from 40 to 70 gallons capacity, containing bicarbonate of soda and other chemicals with which sulphuric acid and water may come in



A HOOK AND LADDER AUTOMOBILE TRUCK.

contact to generate carbonic-acid gas at such pressure as to be forced with the water through a small hose. This apparatus has been used with considerable success in some fire departments, but it is fair to say has been ignored or found unavailable in others. Especially is this true of New York city, where the practice has always been to concentrate at a fire adequate pumping power at the earliest possible moment and to use large quantities of water, the idea being to take no chances and even at the risk of water damage to err on the side of safety.

In the horse-drawn combination wagon the chemical tank and the small hose usually carried upon the driver's seat is but an incidental feature, the body of the wagon being reserved for larger fire-engine hose. But in a properly designed automobile such apparatus can be sped to the scene of a fire with four to eight men at from 40 to 60 miles an hour. Thus for a fire in a small suburban dwelling, in the majority of cases, a chemical engine brought close to the house with its 200 feet of ¾-inch hose, is able to extinguish an incipient fire. Such motor cars are built with engines from 24 to 50 horse-power. Because of the peculiar service conditions they are usually of the air-cooled type to obviate danger of freezing in winter. The tanks vary in capacity. It is considered good practice to install two tanks, so that one can be refilled while the other is in use. It would seem desirable that such chemical engines be supplied in the majority of fire departments to answer at once on the first alarm.

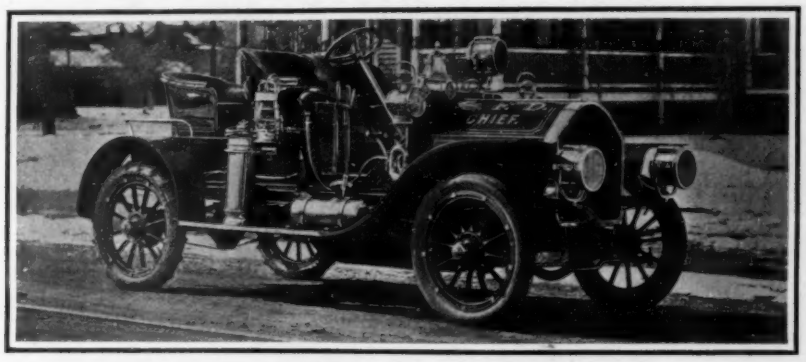
The next step in the progress of the small motor chemical engine was to make it larger and to add to its equipment. Accordingly combination engines were designed which not only carried the chemical equipment but also hose for the following steam engine, scaling ladders, tools, and other apparatus, thus enabling the men to prepare the way for more serious operations and saving valuable time. In this field a number of very efficient types have been evolved.

Next in mechanical development comes the motor

(*Continued on page 69.*)

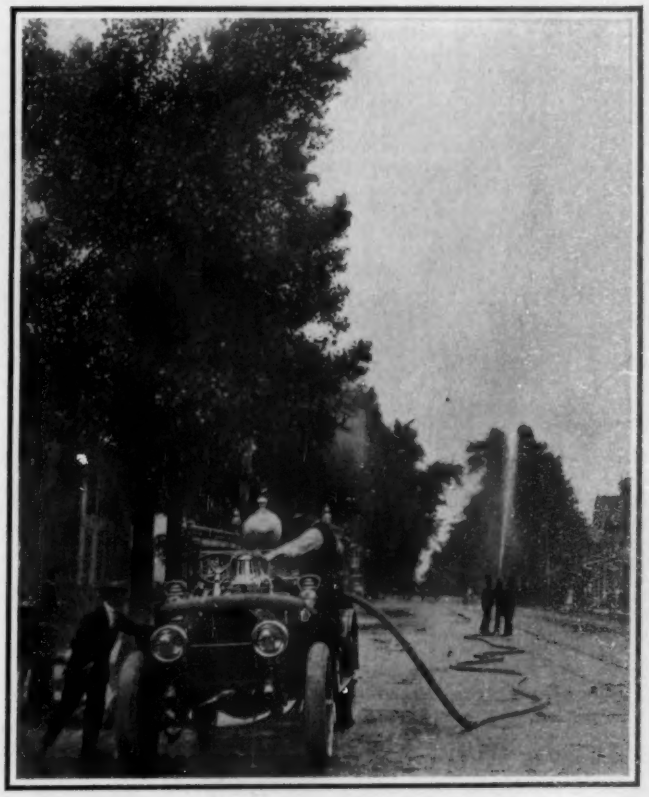
A NEW YORK AUTOMOBILE HIGH-PRESSURE SERVICE WAGON.

AN AUTOMOBILE HOSE CART.

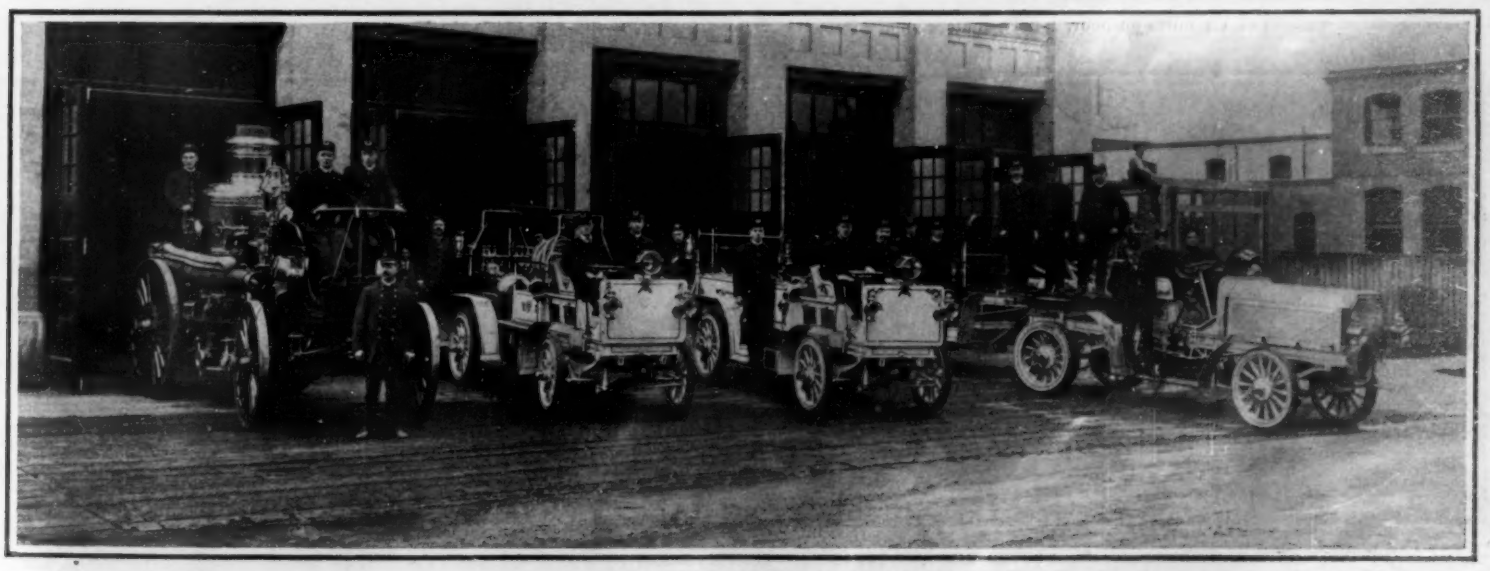


FIRE CHIEF'S AUTOMOBILE.

A COMBINATION TRUCK FOR SMALL COMMUNITIES.



MOTOR-FIRE PUMP AT WORK.



A COMPLETE AUTOMOBILE FIRE DEPARTMENT.

AUTOMOBILE NOVELTIES.

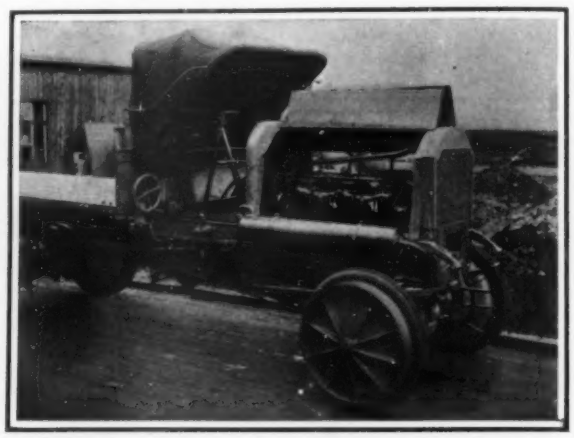
SOME INTERESTING DEVICES FOR THE SEASON OF 1910.

A HEAVY TRUCK WITH FOUR-WHEEL DRIVE.

BY DR. ALFRED GRADENWITZ.

The adoption of trucks in rural districts is a difficult though very important problem of the automobile industry. Bad roads and sandy soil create a number of difficulties which can be overcome only by special construction.

TRACTOR TRUCK (60-HORSE-POWER 6-CYLINDER) HAULING A TRAILER.



THE 60-HORSE-POWER MOTOR OF THE FOUR-WHEEL DRIVE TRUCK.

One of the most important points seems to be the utilization of all four wheels for driving, thus increasing the adhesion. This is especially imperative in the case of heavy motor cars employed as tractors for load trains consisting of two or three vehicles, where a weight of several tons acting on the fore axle can be utilized for adhesion.

The Daimler Motor Works, of Germany, have constructed for a well-known Berlin export firm a heavy truck with four-wheel drive, which is being shipped to South Africa, in order there to take up its heavy duties in propelling, as tractor, a train of 10 to 15 tons. This car shows a number of technical features of interest.

The chassis is made of compressed sheet steel girders with compressed transverse beams and lateral shields. The six-cylinder explosion motor, located in a three-point suspension, yields 60 horse-power at the brake, with 930 R. P. M. This motor is of the familiar Daimler type with magneto-electric ignition.

The maximum speed of the car is 10 miles per hour. The low minimum speed, ¼ mile an hour, is remarkable, thus fully utilizing the advantage of four-wheel drive for the overcoming of gradients and traveling over sandy soil without increasing the dimensions of the gear case. As only the fore wheels are steerable the rear wheels are driven through a toothed-wheel drive.

The cast-steel wheels have broad rim flanges which are intended to prevent the vehicle from penetrating too deeply into the sand. The solid rubber tires are pressed immediately on the wheels. The fore wheels are steered essentially in the same manner as other cars through worm gearing. The vehicle is equipped with four brakes, operated independently of one another, viz., a gearing brake, two differential brakes, and one rear-wheel brake. The motor car, which is designed for a useful load of 5 tons, is able to haul two trailers of the same capacity while negotiating gradients of about 15 per cent with this total load of 130 hundredweight at a speed of 1¼ miles an hour.

With a single trailer gradients of 7 to 8 per cent can be negotiated at a speed of 5¾ miles, so that the car seems well suited for making its way with the trailers also through deep sand.

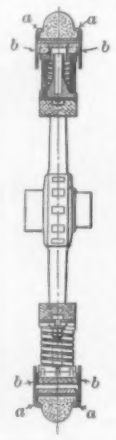
The weight of the car, inclusive of its equipment, is about 12,540 pounds, of which about one-half falls on the fore axle, so that about 6,270 pounds on the fore axle is utilized for adhesion.

THE PARSONS SPRING MOTOR WHEEL.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The many well-known defects of the pneumatic automobile tire have prompted many inventors to attempt to evolve an efficient and reliable substitute therefor without any sacrifice of resiliency. The general trend of inventive effort has been to secure this quality by some elaborate arrangement of springs, without, however, completely solving the problem.

Early in 1906, however, the Hon. R. Clere Parsons, M.A., M.Inst.C.E., directed his attention to this subject. The object of his quest was to devise a wheel which should be as resilient as the pneumatic. Although the first cost of such a wheel might be somewhat higher than the pneumatic, such a difference would be more than compensated for by nance expenses and the wheel. He has wheel illustrated in photographs.



Longitudinal section through Parsons spring wheel.

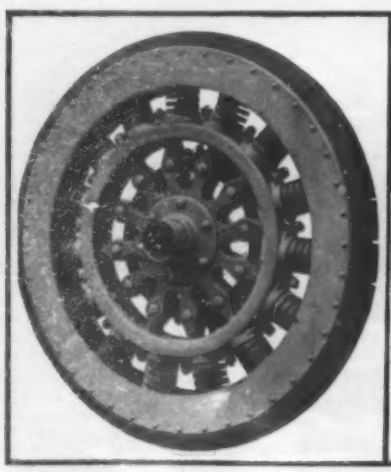
The "Panflex" spring wheel comprises two essential parts—a double channel rim, consisting of (1) an outer steel channel *aa* into which a solid rubber tire is pressed, and an inner channel *bb* formed by riveting thin rings of non-oxidizable metal on either side of the outer channel; and (2) inner radially disposed coiled springs. In a driving wheel the channel rim is furnished with corrugated segments having polished surfaces, riveted around the internal surface of the steel channel for the dual purpose of transmitting the driving force of the engine and the retarding force of the brake from the wheel center to the outer rim. In a non-driving wheel the corrugated segments are dispensed with, and are replaced by a smooth strip of hard bronze. This channel has no connection with the spring wheel proper.

The general design of this inner section may be comprehensively gathered from a reference to the illustration showing the wheel center complete. It comprises an ordinary wooden-spoked wheel of small diameter having a groove around its circumference on each side of which is shrunk a steel band or tire in such a manner that a grooved space is left to receive the heads of the T-bolts, by which the spiral springs are secured to the rim of the wheel center. These spiral springs are of the ordinary cylindrical type, so coiled as to fit into aluminium castings at either end, and with such spaces between the coils that when compressed, the steel is not overstrained. For protection against rust the springs are sherardized, and, moreover, each end is thoroughly tinned for a length of about half a coil.

The aluminium castings by which the springs are attached to the wheel center are of special design. On one face they have a spiral tunnel or thread, so that the spring may easily screw into them, and are also provided with suitable lugs in order that they may be gripped by the T-bolts. A steel tube is also cast into the aluminium base which projects up the axis of the spring as shown in the illustration.

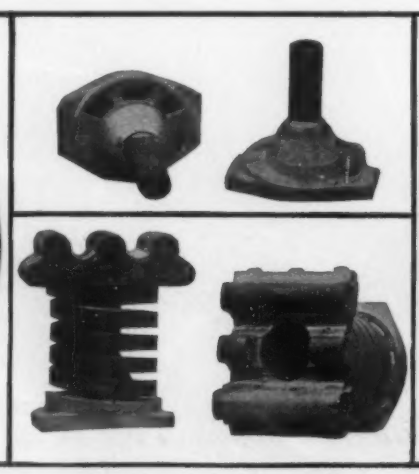
The aluminium castings forming the caps for attachment to the outer ends of the springs, are also provided with spiral tunnels on one face into which the spring screws, while the other face has dovetailed grooves into which rubber strips of a section similar to those used for carriage tires are forced. A hole is drilled into the center of these caps, having a diameter considerably greater than that of the steel tube attached to the base, so that a space is left between the tube and the casting. The advantage of this arrangement is that in the event of the application of an excessive side force, such as sudden and violent throwing in of the clutch or braking, or the wheels being caught in a rut, the tube comes into contact with the side of the hole, thereby preventing the spring from being overstrained in any direction at right angles to its axis. In the case of high-powered automobiles, the rubber strips are replaced by a solid rubber pad vulcanized to a steel plate which is attached to the aluminium cap.

The springs are inserted into the spiral tunnels at

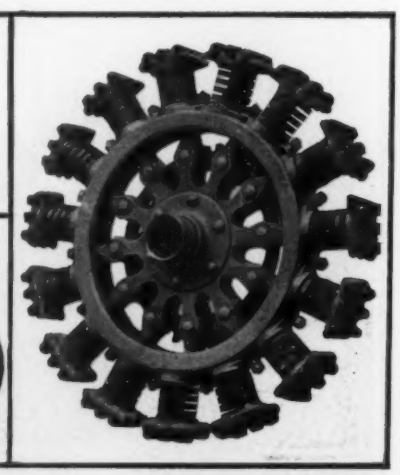


THE COMPLETE WHEEL ASSEMBLED WITH ALL ITS SPRINGS.

THE OUTER RIM AND TREAD OF THE SPRING WHEEL.



BASE MEMBERS TO WHICH SPRINGS ARE ATTACHED. SPRING, BASE, AND CAP ASSEMBLED.



THE SPRING WHEEL WITH OUTER RIM REMOVED.

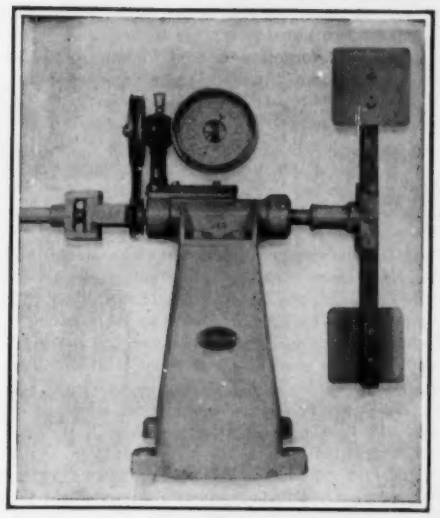
their respective ends, and after correct adjustment are heated to a certain temperature, insufficient to injure their temper, and melted solder is then run in, which unites with the tinning on the spring, and securely combines the base and spring together, in such a manner as to preclude any possibility of their becoming loosened.

The lower springs, i. e., those just above the point of the wheel's tread, are compressed under the weight of the vehicle, while those at the top do not touch the circumference. The spring portion is therefore practically "floating," for at no part is there any rigid connection between the inner and outer parts of the wheel. When the wheel is in motion the spring and caps in its lower portion take the whole of the weight of the vehicle, and are brought tightly into contact with the rim, but do not shift their position relatively thereto. As the wheel moves forward the springs become disengaged, and move round like the spokes of a rigid wheel, their places immediately being taken by others. The disengaged springs travel forward relatively to the rim in the direction in which the vehicle is moving. The result is that the central portion of the wheel makes a slightly greater number of revolutions than the outer rim in a given distance. At the same time, however, it is impossible for the inner part to travel round independently of the outer rim or tread of the wheel, since it is always tightly in contact therewith at the point of the wheel's contact with the ground, which is the point of application of the vehicle's weight, the rubber strips of the outer extremities of the springs establishing such adhesion upon the surface of the interior of the rim as to prevent any possibility of slipping. Yet there is no perceptible wear and tear upon the two contact surfaces. In the case of the driving wheel, the gripping power of the spring members is very considerably augmented by having the corrugated surface as already described.

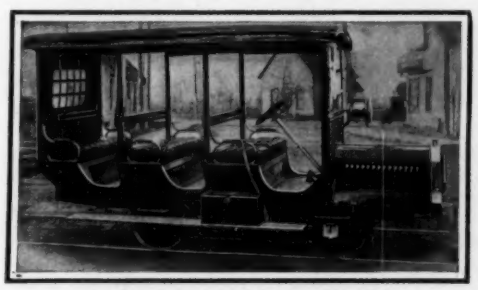
The successive compression of the springs, as the wheel revolves, is quite continuous and is effected with the utmost smoothness, as the spiral springs with their caps can be deflected in every direction. Sudden jerks or concussions cannot occur, which even with pneumatic tires are unpleasant features when traveling at high speed over a bad road surface.

It may be thought that the absence of rigid connection between the inner and outer parts of the wheel may be disadvantageous, but experience has quite conclusively demonstrated that no such drawback exists. It is practically impossible for any slipping between the two parts to occur, even when the vehicle is badly driven. There is no friction between the rubbers in the free ends of the springs and the internal surface of the channel rim. The springs as it were walk round the inner circumference of the outer rim, on a polished metallic surface, and are successively loaded with their due proportion of the car weight during each revolution. The moment the weight is applied to any spring, the latter cannot possibly move relatively to the rim until the weight is released. Consequently, there is an entire absence of friction, and the rubber shoes in the spring caps will last as long as the wheel tire. Even in the rare event of the rubbers of the spring end becoming damaged, it is an insignificant item in renewal, but no such occurrence has yet been experienced, though wheels have been driven for thousands of miles. Even the entrance of dust or mud has no deteriorating effect upon the two surfaces.

The wheel has been severely tested upon a 28-36 horse-power Daimler motor in comparison with the heaviest make of English pneumatic tire. True, the "Panflex" wheel is somewhat heavier than the pneumatic, but it has been found that such is no disadvantage, the mileage possible per gallon of fuel under the selfsame conditions being approximately the same. Trials have shown that the average life of the outer solid rubber tire is from 10,000 to 12,000 miles, which is about two and a half times that of the ordinary pneumatic type. Though in first cost the "Panflex" wheel is more expensive than the pneumatic, this difference in initial outlay is soon recouped from the reduced running expenses. It has been found that the cost per mile with the pneumatic averages about 1.98 cents, as compared with 0.48 cent for the spring wheel—a difference in the latter's favor of 1.50 cents. Moreover, as the wheel itself is practically everlasting, the renewal charges are limited to the solid rubber tire, which costs much less than a pneumatic of the same dimensions, and the rubber caps of the spring members. Occasionally, as the result of a very severe concussion or jolt, a spring might break. This can be easily and quickly replaced on the road; but as the deflection of the spring is limited in every direction by the central tube, the stress to which the steel is subjected need be no greater than that in the side springs supporting the automobile. Such an eventuality is therefore remote. Again, with this wheel, in view of the ingenuity of its construction, the ever-existing danger of side slipping is reduced to a negligible quantity, owing to the flexibility of the wheel.



A FAN DYNAMOMETER FOR TESTING MOTORS.



LAMBERT AUTOMOBILE RAILWAY CAR BUILT FOR HARRIMAN BRANCH ROADS.

AN AUTOMOBILE CAR FOR RAILWAYS.

The accompanying illustration shows a special car ordered by E. H. Harriman before his death, which is to be used on a private road running from a point on the Erie Railroad to the Harriman private residence.

The car is a Lambert friction drive, and was ordered for the purpose of ascertaining whether a gasoline car for from 12 to 15 passengers could be utilized more economically than steam cars on branch roads on the Harriman lines. Whether a car of this character will come into general use will depend upon the result of experiments to be made.

AN AUTOMOBILE BUFFET TENDER.

A novel automobile tender has been devised by Mr. G. L. Reeves. Mounted in the body across the rear end is a three-burner gasoline stove, connected with a one-gallon gasoline tank. Next forward is a receptacle in which is fitted a complete cooking outfit, each article nesting and telescoping into the other. The outfit consists of two frying pans, four boiling vessels, coffee pot, twenty serving plates, three sauce pans, and eight soup tins. To the left of the cooking outfit is a three-bin vegetable cellar with tray lid for large cooking spoons, cake turners, carving forks, etc. To the right is a galvanized-iron-lined refrigerator containing six one-pint glass sealers, ice receptacle, and large meat tray.

Immediately forward of the refrigerator, and extending to the end of the bed, is a seven-gallon water cooler. To the left of the water cooler is a thirteen-drawer cabinet intended for all grocery and cooking staples, knives, forks, spoons, tea towels, table covers, etc. In the little open court there is just room for two telescoping dish pans to disappear.

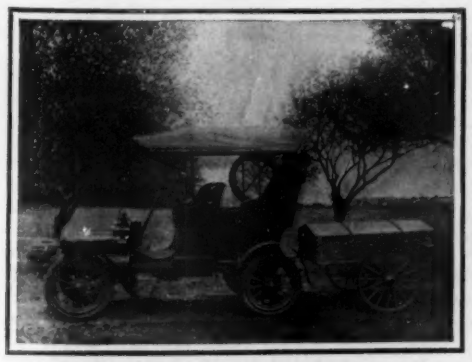
The accompanying picture showing the kitchen open indicates that the two covering lids when opened out form two spacious serving tables. These lids are covered on the inside with padded oilcloth, and on the outside with rainproof ducking. The meeting edge of one cover is provided with a patent leather flap, and is held in place in transit by two large straps, which buckle securely and make the tender rain and dust proof. A small brass hasp and lock is also furnished. A neat little folding dining table is strapped to the inside of one of these lids.

An extra broiler, a cooker for emergency, a pocket ax, and a camp lantern strapped to an outside bracket complete the outfit.

The refrigerator and water cooler are fitted with drain cocks. A rigid pair of folding legs is provided to support the end of the body when disconnected from the auto.

The wheels have rubber tires and the several parts are so accurately nested that the tender moves even at twenty to twenty-five miles speed without noise and takes corners perfectly.

The tender weighs 475 pounds, and the extra draft on the automobile is scarcely perceptible. It has been used in serving a great many roadside dinners, and its entire practicability for such service established beyond doubt.



THE BUFFET TENDER UNDER WAY.

THE BUFFET TENDER IN USE.

A FAN DYNAMOMETER.

The standard type of fan dynamometer shown in the accompanying photograph has been devised by Joseph Tracy. It consists essentially of a metal standard carrying a horizontal steel shaft in large ball bearings. One end of this shaft is connected with the motor under test by a universally jointed extension shaft; the other end carries an overhung two-bladed fan, as shown. On the dynamometer shaft a small pulley fitted to a boss on the rear of the universal joint is belted to a larger pulley on the special tachometer, which is mounted on top of the housing that carries the dynamometer shaft.

The tachometer of the standard fan dynamometer is provided with a double scale and single pointer, the inner scale showing the revolutions per minute, and the outer scale the horse-power developed. The revolutions per minute scale is graduated progressively by divisions of 20 revolutions from 200 to 2,000 revolutions. The horse-power scale gives a minimum reading of 1 horse-power at 480 revolutions, and a maximum reading of 70 horse-power at 1,980 revolutions. Consequently, at all ordinary rates of motor speed a simultaneous reading of revolutions per minute can be obtained without any computation.

The standard fan dynamometer can be employed in testing motors on the block by making suitable connection between the jointed dynamometer shaft and the motor shaft, clutch, or flywheel. It can also be used to test an automobile motor in position on the chassis by disconnecting the propeller shaft, and substituting for it the jointed shaft of the dynamometer.

The standard dynamometer is designed to test motors of medium-sized cars. However, by the use of fan blades of greater or less area, and suitable tachometer scales, the range of absorption and measurement of power can be varied between wide limits.

The Tenth National Automobile Show in Madison Square Garden afforded a good opportunity of inspecting the product of representative American makers. The exhibition brought out some novelties in construction and design which showed a gratifying tendency toward standardization. That the modern, everyday motor car, generally known as a stock car, has left the misty zone of experiment and is now a practical and useful machine was strongly emphasized by the many performances in hill-climbing, touring, and racing contests of 1909. There is a comprehensive display at the Garden of duplicate models of the stock cars that competed successfully in the various sporting events of the year. Some of the original cars are shown. Thanks to the adoption of certain standards, a new model need no longer be put through years of testing before it is entered in competition with other cars. Recently victories have been won by certain makes of cars that had scarcely competed in previous events.

ANTI JOY RIDE DEVICES.

(*Continued from page 49.*)

made by flexible shaft connection with one of the vehicle wheels.

5. Combination mechanisms, embracing switch and engine hood lock and vibration recorder.

Some of these devices are now to all intents practically obsolete and out of the market, and there never has been any general demand for any of them except those intended merely to prevent meddlesome persons and mischievous children from tampering with machines left standing at the curb. The one class of device that is in almost universal use is the lock switch. Almost every large manufacturer of ignition spark coils and switches offers a current switch with a removable plug or lever or fitted with a lock and key by which the connection between the battery or magneto and the engine spark plugs can be broken and prevented from being re-established readily.

The type of switches with removable plug is illustrated in Fig. 1. Switches of this type are known as plug cut-out switches and are now designed to be used with a dual system of ignition, so that either the battery or magneto can be switched into use or the current from either of two batteries turned on. When the car is stopped, the metal plug, with insulated handle, which makes connection between the two terminals within the switch, as shown in the underside view, Fig. 1, is withdrawn and the circuit is broken. The engine cannot then be restarted until the plug has been replaced or electrical connection has been re-established in some other way. The plug is small and can be carried conveniently in the pocket.

A modification of this type which precludes the possibility of inserting a nail or piece of wire as a substitute for the plug is shown in Fig. 2, in which the switch lever is removable. There are numerous makes of such switches. The end of the lever engages by a slot or keyway with a post that prevents it from dropping off and at the same time assists in forming an electrical connection. The other end of the lever, fitted with a non-conducting composition handle, can be swung in an arc or complete circle to make contact with any desired contact button for use of batteries or magneto or to neutral "off" position.

A further development of the lock-switch idea is seen in the auto lock plug (Fig. 3) in which a Yale lock is applied to a plug cut-out switch in such a way as positively to prevent the closing of the circuit through the switch without the proper key or its duplicate. The lock is placed directly above the plug socket, thus preventing the insertion of a nail or wire. The cut-out plug is connected with the mechanism of the lock so that it is thrust in or out by the turning of the key. The key cannot be removed from the lock until the circuit is broken. Each lock requires a different key, of which two duplicates are furnished to the purchaser.

The Yale lock, with sliding plug connection to take the place of the regular cut-out plug, can be fitted to various styles and makes of switches, being held on by screws of a special kind that cannot be removed except with a double-pointed wrench made just to fit the recess in the screw heads.

A device of somewhat similar characteristics to the foregoing is the break-circuit autolock (Fig. 4), which is manufactured in different forms for use on electric and gasoline vehicles. The type illustrated is for electric machines, but the operation of the two styles is similar. When the switch-bar, just above the barrel of the Yale lock, is pulled forward it breaks the circuit and remains locked in this position until one of the two keys furnished with the device is inserted and given a half turn, when the connection is re-established automatically by the switch-bar springing back into place. The electric vehicle lock is installed beneath the upholstering on the arm of the seat, where only the face of the lock is exposed. It takes the place of the ordinary cut-out plug, so that the operation of the lock is no additional bother.

The break-circuit lock for gasoline vehicles (Fig. 5) is made in different styles to apply to various systems of ignition. It is placed on the face of the coil box, taking the place of the usual switch. The switch-bar is round and provided with a winged head, so that it can be rotated to make connection with battery or magneto or to "off" position at will. When it is pulled forward it breaks the circuit completely. It is not necessary, however, to turn the bar or plug to neutral before locking or unlocking the switch.

Another means of accomplishing the purpose of preventing meddlesome persons from using a car left standing in the street or garage is the Rochester steering wheel lock (Fig. 6). This is hinged so that the hasp can be placed around the steering column. A steel pin at the back of the hasp enters a quarter-inch hole drilled through the outer and inner steering columns. When the hole in the inner column, to the top of which is keyed the steering hand wheel, has been brought opposite that in the outer post and the pin of the lock has been inserted through both, the front wheels cannot be turned.

The special feature of this device is the combination lock that renders unnecessary the use of a key, which may be mislaid, forgotten or lost. The barrel of the lock contains three tumblers each provided with a small lug on either side which engages with the corresponding lug on the next tumbler. Two tumblers are fastened to an internal top cap but are free to rotate on its center pin, while the third tumbler is removable and lies in the body or casing of the lock over a solid post that passes through its center. All the tumblers have a large notch in the periphery. To open the lock it is necessary to turn the external dial hand until all of the notches in the tumblers are brought into line, allowing the catch of the hasp to pass. This can be done only by working the lock combination.

The lock can be operated in the dark, as the dial is notched so that by starting at 0—which is distinguished by a large or open notch—the movement of the hand over the dial can be counted as the spring points drop successively into the serrations. When the lock is open, the combination can be changed in two minutes if desired. Except for the steel pin, this lock is made entirely of bronze and is made in different sizes to fit steering columns of different diameters. The manufacturers have also produced an adjustable hasp steering column lock made with four-tumbler combination and operated by a key.

In division *B* of group 2 is a new invention brought out this season under the name Bongartz autolock (Fig. 8). The device is designed as a lock to prevent use of the gear shift lever and, if desired, also of the brake lever. It consists of a simple lock incased in a polished heavy brass case to be attached to the side of the car or the footboard directly behind the lever quadrant, and a rod with a head on one end and a recess in the other end to be engaged by the plunger of the lock. With the gear-shift lever in neutral or inoperative position, a hole of suitable size is drilled through the quadrant and shank of the lever to receive the rod. The lock case is then secured to the body or frame in such position that the hole for the end of the rod will be in alignment with the hole drilled through the quadrant. Now, when the car is stopped and the gears unmeshed, the rod can be inserted and engaged in the lock, when it will be impossible for anyone not possessing the key to start the machine.

A notable advantage possessed by this device is that, while preventing the car from being driven on the road, it does not interfere in any way with its movement by hand in the garage or with the adjusting and "tuning up" of the engine and its attachments by the chauffeur or workmen.

Not only is it essential that the unauthorized use of motor cars should be prevented, but it is almost equally desirable that some measure be taken to curb the speed enthusiasm of the hired chauffeur even when the owner is ocupying the tonneau or interior of the limousine or landaulet. It is not altogether improbable that the owner needs a check on himself, as in the exhilaration of a good road, bracing atmosphere, and smoothly running car he may unwittingly let enthusiasm overstep discretion. Numerous efforts have been made to produce something that would accomplish such results by the sounding of audible signals when the car had attained to a certain speed or by the display of a prominent speed-indicating device that could be read at a distance by every passer-by. The objections to these devices, however, were so obvious that they never met with favor except on the part of persons afflicted with motorphobia and lawmakers eager for popularity among their constituents.

A practical device intended to accomplish the same results in a much better and more effective way has been brought out recently for use in combination with a well-known make of speedometer. This is the Jones automatic speed-control governor (Fig. 9). The mechanism consists essentially of a speed indicator, an automatic circuit breaker, a controller switch, and an electrically operated air valve, not indicated. The electric switch, which has five or more points of contact representing circuits, is operated by the action of the centrifugal governor of the speed indicator. The switch is so arranged that when the indicating hand of the speedometer shows a speed of ten miles an hour the switch will close the circuit through the first contact; when the velocity of the governor is such as to indicate fifteen miles an hour on the dial, the switch closes a circuit through the second contact, and so on up to any desired number of speeds or contacts.

By setting the pointer at any figure on the dial of the controller switch, the circuit can be made to close through the corresponding contact only and at the indicated speed. When this circuit is closed, it actuates the current to the primary of the induction or spark coil, thereby cutting off the spark from the engine. Or it may be arranged to operate the electrically controlled air valve or throttle, shutting off the supply of air or gas to the engine and thereby preventing the speed of the car from exceeding the indicated limit. As soon as the speed is reduced, the contact automatically cuts out and the engine gets its power again. Should the pointer of the controlling switch be set at an intermediate position, as in the illustration, the device will have no action whatever on the speed of the car.

As the controlling switch can be located almost anywhere in the car, it is evident that the owner or any occupant of the rear seat can limit the speed as desired, regardless of the driver. The device operates silently and is always on guard, giving a sense of security in passing through sections where the speed regulations are rigidly enforced.

An example of the vehicle movement indicating instruments classified under *A*, group 4, is the watch-dog vibration register (Fig. 10). This operates on the principle of the pedometer, a pendulum or weighted arm being held normally in a horizontal position by a light spring and caused to beat by reason of the momentum of the weight following every downward and upward movement of the instrument. Each beat of the pendulum releases a tooth in the train of gears which actuate the indicator hand and register figures on the dial. The dial is 2½ inches in diameter and is divided into 100 degrees. These divisions do not represent either hours or miles, but serve as a measure of the vibrations. Different cars oscillate vertically in different periods, it has been found, but each machine oscillates very nearly the same number of times for successive miles irrespective of its speed. Engine vibrations when the car is standing still do not affect the instrument, therefore the device makes no record except when the vehicle is in motion.

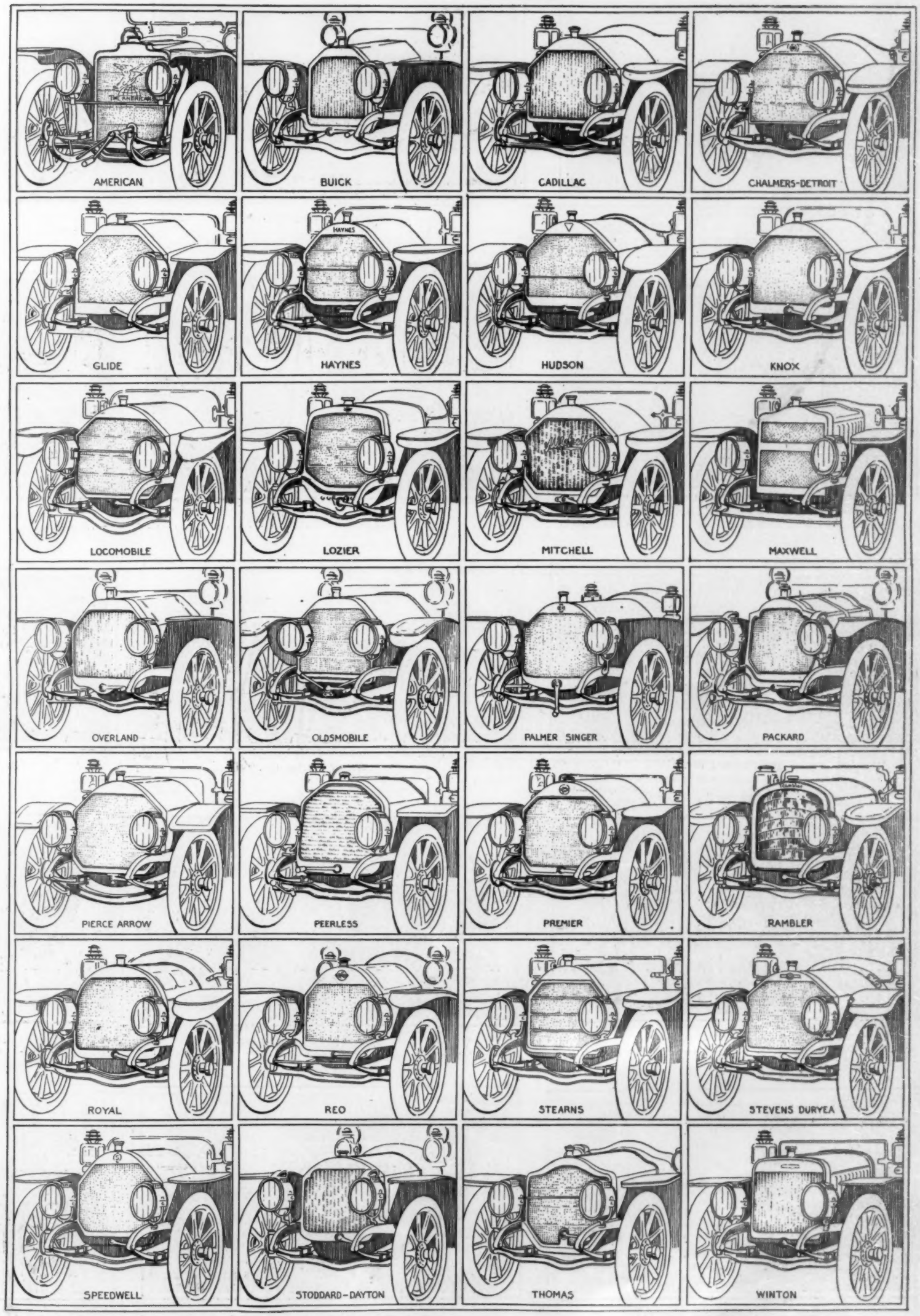
The instrument is intended to be attached permanently to the car so that it cannot be removed without the owner's knowledge and is securely sealed so that no one can tamper with the register. There is no shaft or wires connecting it with any working part of the automobile whose detachment or disconnection would render the recorder inoperative. The owner, having by observation determined that on his machine the instrument indicates say 10 points for each hour of travel, will have no difficulty in determining from the reading of the dial how many hours his machine has been driven after he last had it out.

A different type of vehicle movement indicator is represented by the Bullard recorder (Fig. 7). This provides a permanent record on paper of the hours during which the vehicle was used, the rate at which it was run during every mile traveled and the number and duration of stops made. It operates by a combination of clockwork movement and flexible shaft drive from one of the road wheels. The clock mechanism rotates a circular paper dial that makes one complete revolution every hour in the same direction as the hands of a clock. The dial is divided into sixty radial spaces representing minutes, every fifth line being heavier than the intermediate lines for convenience in reading. From center to circumference there are twelve circular divisions, also corresponding to the hours. Within the instrument is a stylus operated by both the clock and movement of the car, which makes a perforation in the paper dial for each quarter mile traveled, every fourth perforation being deeper than the others to indicate the completed mile. The stylus is at the extreme outside space when the instrument is set for a record and moves toward the center at the rate of one space each hour, being moved by the clock and requiring twelve hours to move across the dial, where it becomes inoperative until reset.

So long as the car stands idle the dial rotates without being punctured by the stylus, but for every quarter mile the car travels (if a pleasure vehicle) one perforation is made. And according as the machine is driven fast or slow the holes are close together or farther part. At the rate of a mile in four minutes, or fifteen miles an hour, there will be just one hole for each radial division, while at sixty miles an hour there would be four. By examination of the dial it is possible to determine the exact hour and minute at which the car was started and stopped. Combined with the instrument is a tiny odometer which registers the total mileage up to 10,000, The instrument depends for operation on a simple train of gears and ordinary clockwork and the same connection with the road wheels as every speed indicator. The inventor decided upon the perforating system because it cannot be tampered with without detection, no jar or jolt of the car can derange it and cold weather or dry cannot render it inoperative. For use on commercial vehicles, which move at a slower rate of speed, the stylus is made to perforate for every eighth mile instead of every quarter,

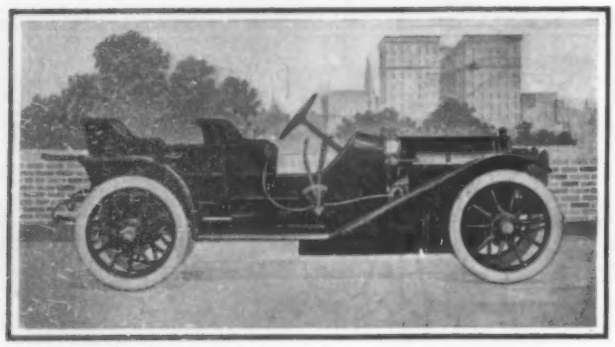
Much the most comprehensive invention to prevent the unauthorized use of motor cars that has been made is that of Leon Ottinger of New York city (Fig. 11). It is called the Hoodenparts recording lock, this trade name being adopted because of the combination of functions it performs, which also brings it into group 5 of our classification. By a single operation it locks both the ignition switch and the hood over the engine compartment, so that it is impossible to raise the hood without the use of the Yale key that fits the lock. Provision can also be made if desired for locking

(*Continued on page 70.*)



Often you have wondered what make of car was that which sped past your eyes or around a curve. Although most automobiles are more or less alike in general appearance, they differ in certain features. The radiator and engine bonnet are among these. With the help of this chart, the cars here presented can be identified by their radiators and engine bonnets.

AN AUTOMOBILE IDENTIFICATION CHART.

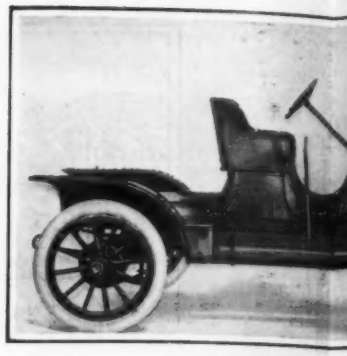


Chalmers-Detroit 40-horse-power pony tonneau.

Cone clutch; four cylinders cast in pairs; bore, 5 inches by 4¾ inches stroke; water cooling with honeycomb radiator; jump spark ignition; shaft drive; selective sliding gear transmission. Price, $2,75[illegible].

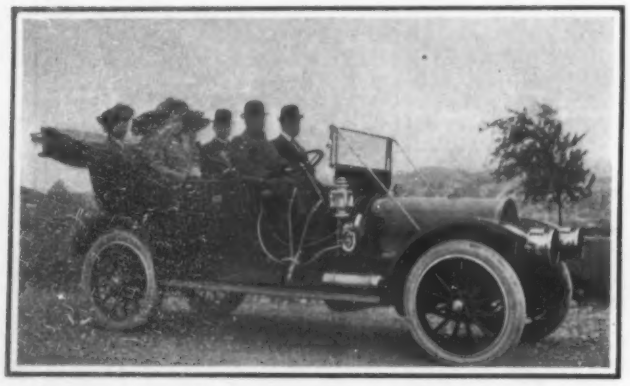
Cartercar, 35 horse-power.

Motor, bore 4¼ inches by 4½ inches stroke; four cylinders cast in pairs; low-tension ignition; friction transmission; non-floating rear axle; chain-in-oil drive; one-lever control. Price, $1,600.



Schacht convertib

Motor, opposed water cooled, 5⅛ inches bore by 4[illegible] sion; chain drive; jump spark ignition; [illegible] rear wheels. Price,

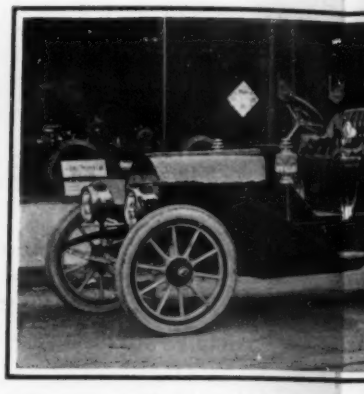


Franklin 42-horse-power touring car.

Multiple disk clutch; 6 cylinders cast separately; bore, 4¼ inches by 4 inches stroke; air cooled; jump spark ignition; shaft drive; selective sliding gear transmission. Price, $5,750.

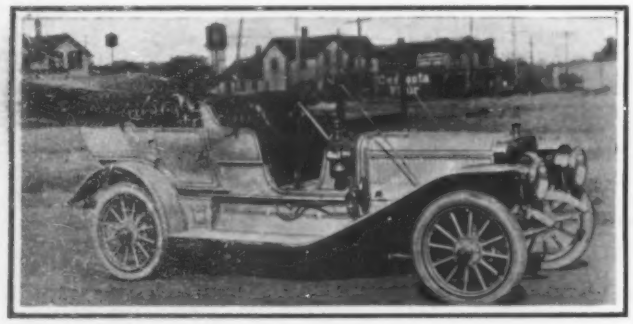
Hupmobile runabout.

Horse-power, 2[illegible]; cylinders, 4 arranged in pairs; bore, 3¼ inches; stroke, 3¾ inches; water-cooled; ignition, high-tension, Bosch magneto; shaft drive; 1 universal joint; selective gear transmission; two foot and two emergency brakes. Price, $750.



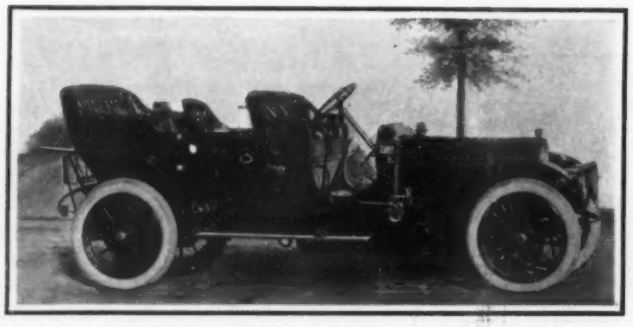
Premier 40-horse-power t

Four cylinders cast in pairs; bore, 4½ inches by 5[illegible] cellular radiator; make-and-break ignition; sliding gear transmission. Pri



Winton touring car.

Horse-power (A. L. A. M. rating) 48.6; 6 cylinders; bore, 4½ inches; stroke, 5 inches; water cooled; jump spark ignition; high-tension magneto and storage battery; shaft drive; selective sliding gear transmission. Price, $5,000.

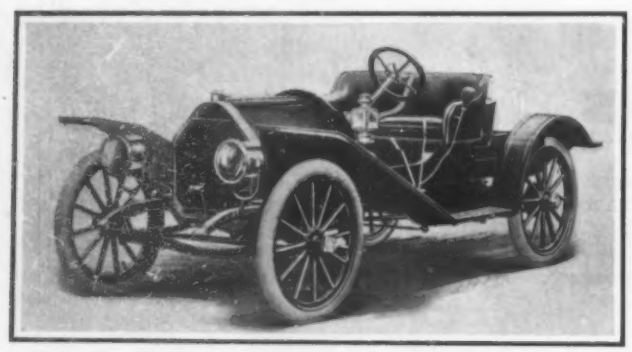


Pierce-Arrow touring car.

Horse-power (A. L. A. M. rating) 48; 6 cylinders; bore, 4¼ inches; stroke, 4¾ inches; water cooled; ignition, jump spark; shaft drive; selective sliding gear transmission. Price, $5,000.

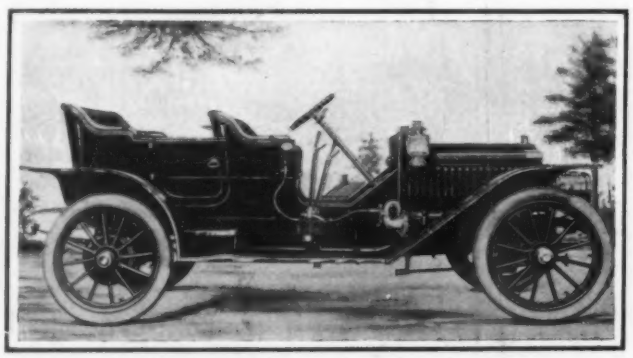
Cadillac 30-horse-power

Cone clutch; contracting and expanding brakes on rear w bore 4¼ inches by stroke 4¼ inches; water cooled wi ignition; shaft drive; selective sliding gear tra



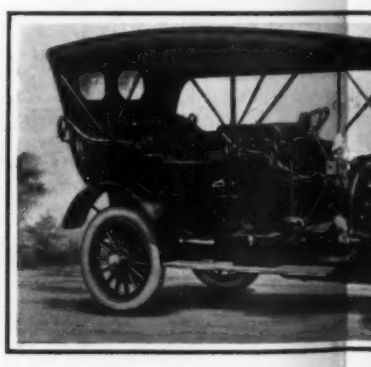
The K-R-I-T runabout.

Wheel base, 96 inches; wheels, 32 inches; sliding gear transmission; horse-power 22½; multiple disk clutch; weight, 1,200 pounds. Price, $800.



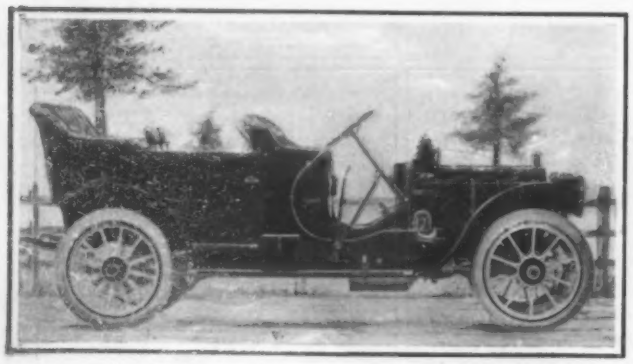
Maxwell 40-horse-power touring car.

Four cylinders; bore, 4¼ inches; stroke, 4¼ inches; water cooled; jump spark ignition; low-tension magneto and dry battery; shaft drive; progressive sliding gear transmission. Price, $1,575.



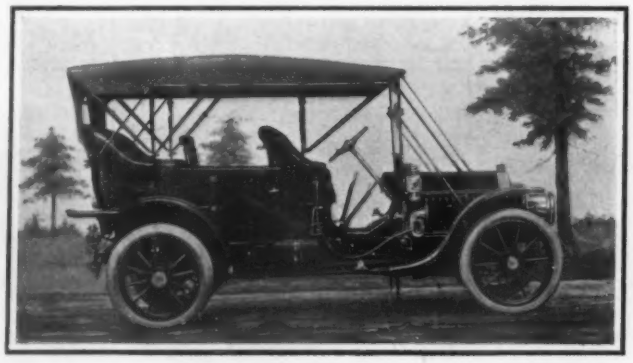
Royal Tourist touring

Horse-power (A.L.A.M. rating), 48; cylinders, 4; bore water cooled; jump spark ignition; shaft drive; t gear; expanding brakes. Price



Packard 30-horse-power touring car.

Four cylinders; bore, 5 inches; stroke, 5¼ inches; water cooled; jump spark ignition; low-tension magneto and storage battery; shaft drive; progressive sliding gear transmission. Price, $4,200.

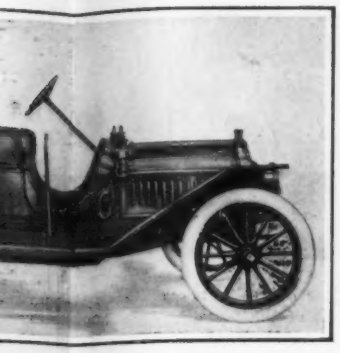


Peerless 30-horse-power touring car.

Four cylinders cast in pairs; bore, 4⅞ inches; stroke, 5¼ inches; water cooled, with tubular radiator; jump spark ignition, with high-tension ignition and storage battery; selective sliding gear transmission. Price, $4,475.

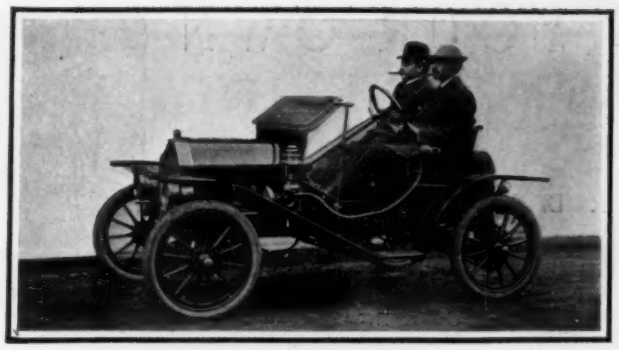
The Hudson r

Cone clutch; horse-power, 22.5; four cylinders [illegible]en stroke; water cooled; jump spark ignition; [illegible] tracting brake on propeller shaft and expan[illegible] on



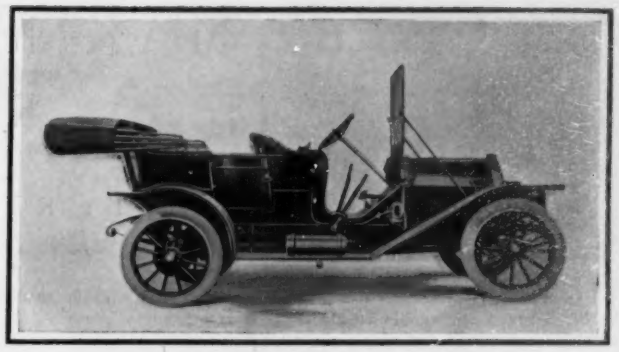
t convertible car.

ches bore by 4¼ inches stroke; planetary transmis-
ark ignition; internal expanding brakes on
wheels. Price, $875.



Brush runabout.

10 horse-power motor, balanced single cylinder, 4 cycle, vertical, 4 inches bore by 5 inches stroke; three-point suspension; internal gear transmission; bevel gear drive; single hand lever control; internal expanding brakes on rear sprocket hubs. Price, $485.



Overland touring car. 35-40 horse-power

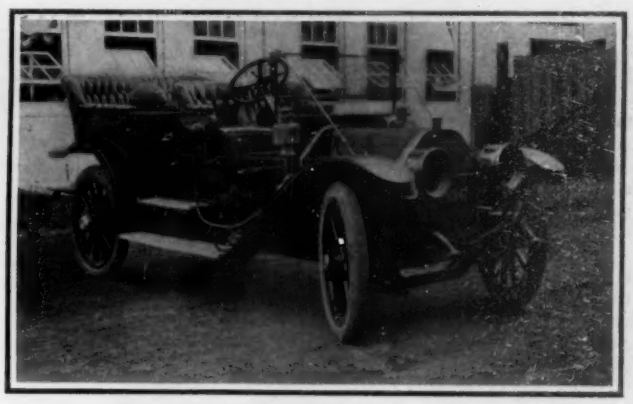
Cone clutch; contracting and expanding brakes; four cylinders cast separately; bore, 4¼ inches by 4½ inches stroke; water cooled, with flat vertical tube radiator; shaft drive; selective sliding gear transmission. Price, $1,500.

rse-power touring car.

inches by 5¼ inches stroke; water cooled with
-break ignition; shaft drive; selective
nsmission. Price, $2,500.

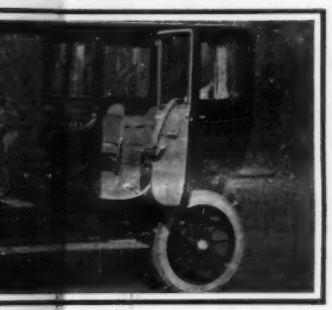
Rambler touring car.

Motor: bore, 5 inches; stroke, 5½ inches; 4 cylinders; ignition, high-tension; transmission, 3 speeds selective; horse-power, 45; brakes on hubs. Price, $2,500.



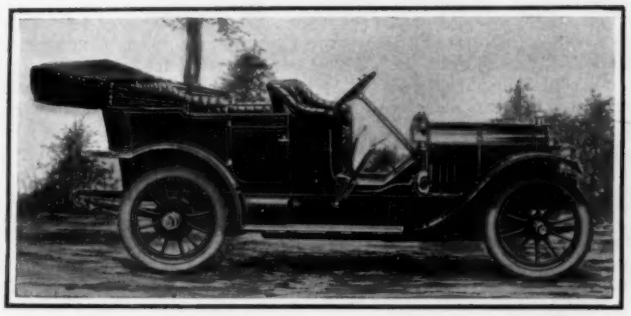
Oldsmobile 40-horse-power special touring car.

Four cylinders; bore, 4¾ inches; stroke, 4¾ inches; water cooled; jump spark ignition high-tension magneto and dry battery; shaft drive; selective sliding gear transmission. Price, $3,000.



horse-power limousine.

brakes on rear wheels; 4 cylinders cast separately;
water cooled with tubular radiator; jump spark
sliding gear transmission. Price, $5,000.

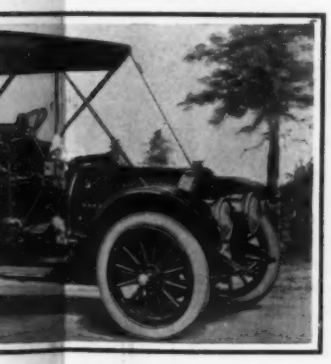


Pope-Hartford 30-horse-power touring car.

Four cylinders; bore, 4⅞ inches; stroke, 5½ inches; water cooled; jump spark ignition; expanding brake on propeller shaft and both rear wheels; shaft drive; selective sliding gear transmission. Price, $2,750.

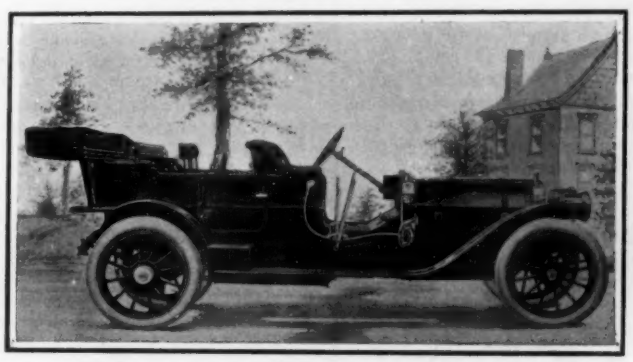
Baker electric runabout.

Bevel gear shaft drive; semi-floating rear axle with ball bearings; motor, four-pole series wound; controller, continuous torque drum type with 6 speeds forward and 3 reverse; 3 brakes, 2 internal and 1 emergency. Price, $2,000.



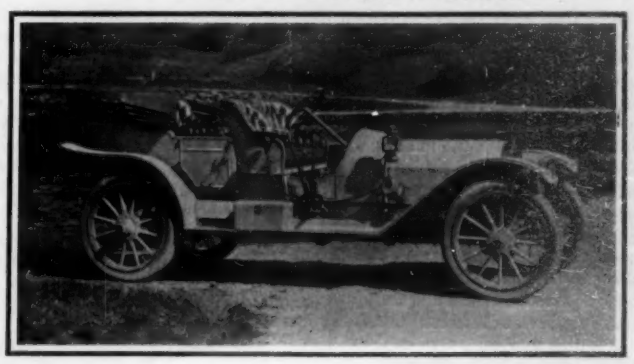
arist touring car.

linders, 4½ bore, 5¼ inches; stroke, 6 inches;
shaft drive; transmission, selective sliding
g brakes. Price, $4,500.



Mitchell touring car.

Horse-power (A. L. A. M. rating) 43.8; 6 cylinders; bore, 4¼ inches; stroke, 5 inches; water cooled; jump spark ignition; high-tension magneto and dry battery; shaft drive; transmission, selective sliding gear. Price, $2,000.

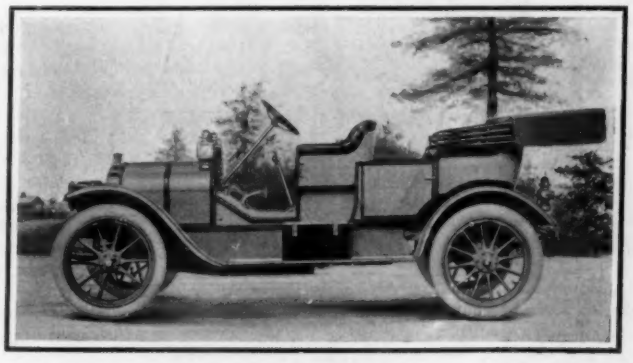


Stevens-Duryea touring car.

Horse-power (A. L. A. M. rating) 36.1; 4 cylinders; bore, 4⅝ inches; stroke, 4½ inches; water cooled; jump spark ignition; high-tension magneto and dry battery; shaft drive; transmission, progressive sliding gear. Price, $2,850.

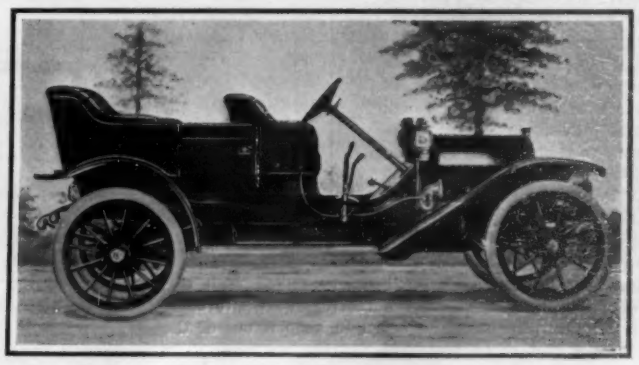
ndson runabout.

linders en bloc; bore, 3¼ inches by 4½ inches
gnition; selective sliding gear transmission; con-
nd expanding on both rear wheels. Price, $900.



White 20-horse-power gasoline car.

Cone clutch; 4 cylinders cast en bloc; bore, 3¾ inches; stroke, 5½ inches; water cooled; jump spark ignition with high-tension magneto; shaft drive; selective sliding gear transmission. Price, $2,000.

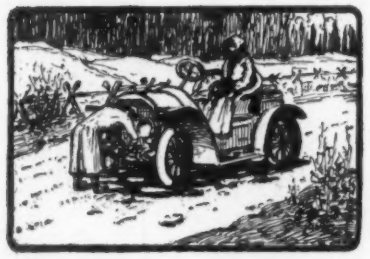


Everett-Metzger-Flanders 30-horse-power touring car.

Wheel base, 108 inches; four cylinders cast in pairs; bore, 4 inches; stroke, 4½ inches; water cooled; jump spark ignition; selective sliding gear, transmission. Price, $1,250.

MAKING YOUR OWN REPAIRS.

BY ROGER B. WHITMAN.



To one who is familiar with the methods employed in the average automobile repair shop, it is not surprising that owners of cars complain of the size of their bills. The principal charge is usually for labor, at so much an hour, but there is no way in which the owner can assure himself that part of the time charged for was not wasted. The difficulty of checking a labor charge is an inducement to a mild form of swindling, and it must be admitted that there are shops in which an hour's work by an untrained boy is charged for at the rate for skilled labor. Then again, time may be wasted unintentionally. It is not unusual to find that after assembling an engine or a gearset, the work must be undone in order to fit an overlooked part, or to correct an adjustment that should have been attended to in the first place, and in such an event the total time occupied is usually charged to the owner of the car.

When the prospective purchaser of an automobile is of a properly inquiring turn of mind he will ask his friends to let him see their bills for repairs and maintenance, and will probably gain the impression that automobiling is an expensive diversion. If he has any mechanical ability, however, he will realize that three-quarters of the work charged for could have been done with simple tools and an ordinary knowledge of their use.

Aside from the economy of it, the owner who does his own work becomes so familiar with the mechanism that it is instinctive with him to recognize the signs of coming trouble. He corrects faults at their inception, and by so doing he obviates an otherwise inevitable delay and expense.

The following notes are offered as suggestions to the owner who desires to render himself independent of the repair shop:

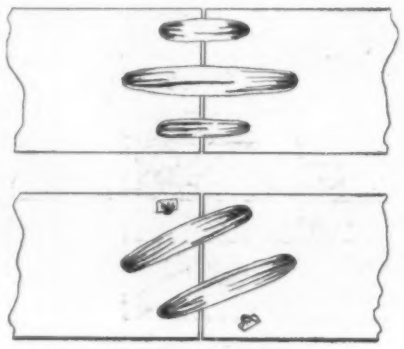
VALVE GRINDING.

At more or less frequent intervals, the valves of a gasoline engine, and particularly the exhaust valves, will become roughened and pitted. When they are in this condition they cannot be expected to retain the compressed gases, and in consequence the engine cannot deliver its full power. It then becomes necessary to "grind in" the valves, which is accomplished by introducing an abrasive between the valve and its seat, and rotating the valve under light pressure until the surfaces are worn smooth. This is usually considered to be a job for a repair man, but as it is patience rather than skill that is required, the car owner need not hesitate to undertake it.

Before grinding can begin the valve must be relieved from the pressure of its spring. In many engines the valve seat and spring are contained in a cage that is easily removed, and the detaching of the spring from the stem is an easy matter. When the valve seat is integral with the cylinder, the spring may be compressed by means of a special tool, or by a flat metal bar used as a lever. To prevent the valve from moving, a small block of wood may be placed between the valve disk and the valve cap. When the spring is compressed, the device through which it acts on the valve stem may be removed. The valve may then be taken out through the valve cap opening.

When a valve is in bad condition, the surfaces of the disk and seat are rough and pitted. It is not necessary to continue the grinding process until the entire width of the surfaces is smooth, for a narrower ring or belt is sufficient to retain the gases, if it is continuous and uninterrupted. Finely powdered emery mixed with machine oil is a satisfactory abrasive, but whatever is used, great care must be taken to keep it out of the cylinder and away from the bearing surfaces. The passage between the valve pocket and cylinder should be tightly plugged with cotton waste, a string tied to it facilitating its removal when the work is completed.

For a badly worn valve, the first grinding is done with coarse emery, which is later replaced by a finer grade to give the requisite smoothness. To apply the abrasive, dip the finger tip in machine oil and then in dry emery, the small quantity that adheres being applied to the valve surface. The valve is then replaced on its seat and rotated by means of a screwdriver. A bit brace or breast drill may be used, but excellent results may be obtained by means of an 8-inch or 12-inch screwdriver with a round, grooved handle, which is held between the extended palms. A continuous rotary motion in one direction will tend to wear the valve oval, and it is necessary to turn it first in one direction and then equally in the other. A slight back and forth motion of the hands will give this result, and as only a light pressure is necessary, it should not prove tiresome.

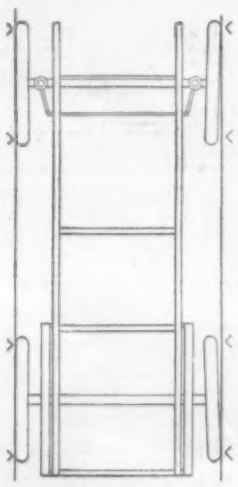


LACING A FAN BELT.

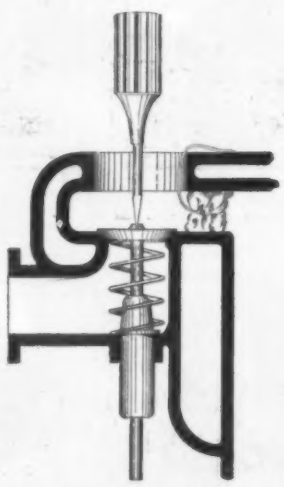
In order to preserve the true circular form of the valve and seat, the valve should be lifted after twenty or thirty turns, and replaced on its seat in a new position. To facilitate this, a few turns of a helical spring may be placed in the valve pocket under the disk, its size and strength being such that the valve will be slightly lifted from its seat when pressure is taken off the screwdriver. The location of the spring is shown in the diagram.

When the valve surfaces appear smooth, all traces of the emery should be washed away with gasoline, care being taken that it does not lodge in the cylinder, valve stem and push rod guides, or other bearing parts. To test the fit, make pencil marks on the valve seat, and give the valve a turn or two with the screwdriver; if the fit is correct the marks will be erased.

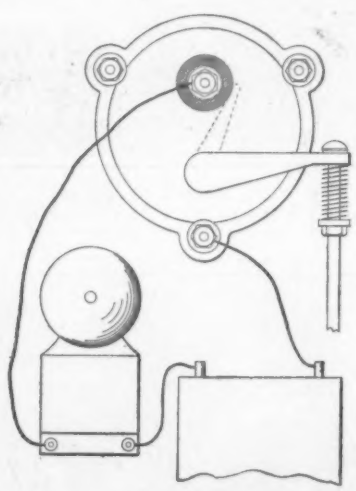
The replacing of the valve spring is greatly simplified if it is compressed in a vise and bound in the compressed state by light iron or copper wires passed through it lengthways. The spring may then be placed on the valve stem and the holding device attached, after which the wires are cut.



LINING UP THE WHEELS.



GRINDING A VALVE.



TIMING AN IGNITER.

"TAKING DOWN" A MACHINE.

When the average man finds it necessary to take any kind of a machine to pieces he is inclined to consider results rather than methods. He unscrews all of the nuts and bolts that are to be seen, and as each comes off he lays it down wherever there is room to put it, regardless of order or system. He is not likely to notice the exact position of a piece before he takes it off, and in general is unobservant of the foresight that would go far to simplify the reassembling. If time is not an object, he will eventually get all the parts properly rebuilt, but if he aspires to be a good workman, he must learn to be methodical in everything that he does.

The first step in dismounting any part of an automobile is to ascertain what holds it in position, what other parts may have to be displaced in order to get at it, and what parts may be released by its removal. To take off an inlet manifold, for instance, it may first be necessary to remove the carbureter, which in turn will require the disconnection of the gasoline pipe and throttle control.

The plan of action having been determined, work may begin. It will greatly facilitate reassembling if nuts, bolts, screws and other small parts are placed in boxes, the parts belonging to the inlet pipe in one, inspection plate bolts in another, and so on. If these parts are laid indiscriminately on the engine and frame they are only too likely to fall into hand holes and other openings, and aside from the difficulty of recovering them, they must then be sorted.

Where several parts are alike in shape and size—valve caps, for instance—it should not be taken for granted that they are interchangeable. Each may have been fitted to its particular location, and on the chance of this they should be marked before being removed so that there may be no error in returning them. Some manufacturers are careful to mark all parts by letter or figure, or with a prick-punch, and when this is the case the marks should be followed absolutely. In the case of gears, it is usual to make three punch marks at the point of meshing. To reassemble them correctly it is then necessary only to place the marked tooth of one gear between the two marked teeth of the other.

When taking off a cylinder, the connecting rod should be blocked or supported. Otherwise the weight of the piston will bring it sharply against the crank case, which may suffer in consequence. If the cylinders are to remain off for any length of time, they should be plugged with cotton waste at all openings, and several thicknesses of paper should be tied around the pistons.

In reassembling, all nuts, bolts and screws should be cleaned and oiled before being replaced. Every bolt has its wrench of appropriate size, with which it is hardly possible to exert a breakage strain. When an 18-inch wrench is used on a ¼-inch bolt there is every possibility of the bolt head being twisted off before the operator realizes that it is in danger.

If the parts of a properly made machine do not come off with reasonable freeness when the bolts and nuts are removed, force should be avoided until it is proven to be necessary. Taper pins, keys, and unsuspected setscrews are frequently responsible, and as they must be accurately replaced, their location and direction should be noted and remembered.

It is poor policy to rush a piece of work, and after a few experiences with compression, water and gasoline leaks that could be avoided by giving more time to the job in hand, the motorist will hang in his shop the motto, "Go slow, go sure," and abide by it.

LUBRICATING THE SPRINGS.

It is the practice among automobile manufacturers to fit grease cups to the shackles and eyes of the springs, and the user of a car is inclined to take it for granted that there is nothing more to do for the springs than to turn down these cups occasionally. It should be noted, however, that the spring leaves require lubrication at least once a season. There is a continual sliding motion of the leaves when the spring is in action; if the surfaces are not lubricated they will be subject to undue wear and eventual breakage.

The proper lubricant is a mixture of grease and

(Continued on page 70.)

COMPARES WITH THE COSTLIEST CARS AS A PERFECT SMALL DIAMOND WITH A LARGE ONE

4 Cylinder. 20 H. P. Sliding Gears. Bosch Magneto **$750** F. O. B. Detroit

Hupmobile

A small diamond is relatively just as good and just as valuable as a large one.

In the same sense the Hupmobile is precisely as fine as the largest, the best and the most expensive cars made.

We make the comparison because we want you to learn to associate the Hupmobile in your mind with the finest cars you know.

The Hupmobile claims the right (and that right is conceded by discriminating owners) to travel side by side with the best products of motordom.

It confesses no delinquencies; admits no inferiorities; concedes no advantage save size and carrying capacity, to cars costing twice and thrice its price.

Observe the personnel of its ownership in your own city.

Note that the majority of men who drive a Hupmobile are the men who know good cars—whose private garage, perhaps, houses several fine cars of other types.

The Hupmobile was built to fill a particular need—to supply a special want—to furnish a type of car that was lacking.

Its creators could see no reason why a car carrying two passengers should not be just as good—just as sound and just as trustworthy—as the best big car built.

Every part that contributes to power and speed and staunchness in the Hupmobile is precisely as good and fine as the same part in the best big car.

The two are mates in quality.

The Hupmobile will go anywhere that the big car will go; climb any hill the big car will climb; and do anything the big car will do except that it will not carry the same number of passengers.

When you buy the ordinary car of moderate price, you say to yourself:—

"I am getting just the sort of a car indicated by the price—a moderately good car."

When you buy a Hupmobile, on the contrary, you buy a quality and a degree of excellence with which the price has nothing to do.

If the Hupmobile were any bigger, it could not be made as good without increasing the price.

SPECIFICATIONS

ENGINE—4 cylinder 20 H. P., 3¼ inch bore, 3½ inch stroke; L-head type; water cooled; offset crank shaft; fan bladed fly wheel in front; Parsons white bronze bearings; noiseless cam shaft.

TRANSMISSION—Selective sliding gears in extension bolted to crank case; shifting witbout noise.

CLUTCH—Multiple disc type; self-adjusting; enclosed in gear case; running in oil.

REAR AXLE—Shaft drive; Hyatt roller and New Departure bearings; shaft and universal joint enclosed and lubricated by oil from crank case through transmission.

BRAKES—Two foot and two emergency (internal expanding) lined with Thermoid on rear hubs.

IGNITION—Bosch high tension magneto, doing away with spark coil, batteries and connecting wires.

TIRES—30 x 3 inches.

WHEEL BASE—86 inches.

TREAD—56 inches.

SPRINGS—Semi-elliptical front, patented cross spring rear.

EQUIPMENT—Two side and tail oil lamps, dragon horn, tools, repair kit, pump.

WEIGHT—1100 pounds regular equipment.

These things (which are literally true) will explain to you what perhaps, you had not understood before—why you have encountered in the year past so many enthusiastic partisans of the Hupmobile.

Everybody, if you will stop to think backward a little bit, has seemed to say kind things about the Hupmobile.

They have said these things about the Hupmobile because it is the newly good kind of a moderate sized car which we have just described.

A year ago there were less than 100 Hupmobiles in commission.

Today 5,000 are being built, as rapidly as excellence of workmanship with the finest materials will permit of hurry—to satisfy a demand which sprang up in incredible volume before the first hundred cars were completed.

Of course, you want to know all about a car which has been favored with the warmest approval ever extended by the American motor-buying public to any motor car.

Even if you own a car to which you are strongly attached, you would like to have placed before you all the information which will shed light upon a condition so unprecedented as the Hupmobile has created.

And if you are wavering in your choice of a car, your desire to know is even stronger.

Sign and send the coupon.

It will bring you not only the Hupmobile literature, picturing and describing the 1910 Hupmobile in every detail.

It will bring in addition, the name and address of the Hupmobile dealer in your home, or the one nearest you.

We will put you in direct touch with the car, so that you can ride in it and satisfy yourself as to the literal truth of every statement we have made.

Clip the coupon and send it now.

Hupp Motor Car Co.
Dept. Q
DETROIT, MICH.

Send 1910 Hupmobile literature and name and address of Hupmobile dealer.

Name .....

Address .....

As an object lesson, three Hupmobiles were driven through the biting winter weather and deep snows, from Detroit to New York for the Grand Central Palace Show.

HUPP MOTOR CAR COMPANY

DEPT. Q. DETROIT, MICH.

AUTOMOBILE NOTES.

Undoubtedly the weak points in the pneumatic tire, whether it be that of a cycle or motor vehicle, are its cost of up-keep and liability to puncture. It is clear that the direction in which improvements have been made is in the thickening of the tread, so as not only to render punctures less frequent, but also to give the tire a longer life, and thus save expense. In some makes of tire, the increase in thickness of the tread of the outer cover, and in others that of the inner tube, has been so great that most of the resiliency has been lost, and the tire practically becomes a solid one. In order to restore the resiliency, it has been proposed to reduce the air pressure in the internal tube, but this causes not only excessive internal friction between the inner tube and the cover, which is in any case difficult to avoid altogether, but also produces a large flat surface, in contact with the road, which adds considerably to the tractive resistance, especially when the surface of the road is soft. The evils of traveling on slack pneumatic tires are known to all cycle riders, and are carefully avoided by keeping them inflated with a sufficient air pressure. The air pressure which it is necessary to maintain in the inner tubes of the pneumatic tires of a heavy vehicle is not less than 100 pounds per square inch, and should the slightest defect occur which allows the air to escape, the tire is not only rendered useless to support the vehicle, but is speedily damaged if the collapse is not quickly repaired.

At the Tenth National Automobile Show in Madison Square Garden, there will be the only complete motorcycle exhibit in New York in 1910 by the Motorcycle Manufacturers' Association. An inspection of the new models on display there proves that the motorcycle not only is a pleasure vehicle for poor and rich alike—ranging in price from $100 for the small single-cylinder machine to more than $500 for the expensive four-cylinder touring model *de luxe*—but a utility vehicle as well. General refinement seems to be the tendency for 1910. Many improvements have been made in spring forks as the result of hard road contests during the past year. Some of the machines appear with spring frames and longer wheel base, all of which make for the comfort of the rider. As regards the appearance of the motorcycle, better quality and more lasting enamel as well as heavier plating seems to be the aim of the manufacturers. Handlebar control is practically universal, and magneto ignition will be more popular than ever, several of the makers having decided to make this type of ignition standard equipment, instead of optional as heretofore. Increased power apparently is a general tendency, and mechanical oilers are also in evidence, which eliminate guesswork in lubrication, one of the bugbears of riding. Several of the manufacturers have decided to abolish the muffler cut-out which, with the muffler improvement noticeable, should make the motorcycle of 1910 as silent a steed as its forerunner, the bicycle.

Two Chalmers-Detroit chassis models will be manufactured in 1910, the "Thirty" and the "Forty," both a continuation of those presented for 1909. The changes, while important, are not in any case radical. The new Chalmers-Detroit "Thirty" will have a 115-inch wheel base, three inches longer than the 1909 "Forty." It will have 34-inch wheels—two inches larger than last season. The hood will be three inches longer and two inches higher—in keeping with the larger body. The tonneau will be large and roomy. The "Thirty" motor is more powerful this year than last. The 1910 "Forty" has a 122-inch wheel base—ten inches longer than last season. It has 36-inch wheels, and room for seven passengers. The 1909 "Forty" was a five-passenger car.

The Tenth National Automobile Show in Madison Square Garden eclipses any former exhibition of motor cars, motorcycles, and accessories ever held in the famous building. There is a total of 323 different displays, of which there are 34 exhibits of complete cars, besides 246 exhibits of accessories and parts, and 23 motorcycle exhibits. Even with an increase over last year of more than 7,000 feet of exhibition space which the show managers by ingenious methods were able to eke out of the Garden interior, there is not one foot of unused space available for exhibition purposes. This situation is indeed a striking commentary on the growth of the industry when it is realized that at the first automobile show in this country, in 1900, there were only 60 exhibitors who displayed their product in the Garden.

Noteworthy among the runabouts costing much less than $1,000 is the Hupmobile made by the Hupp Motor Car Company, Detroit, Mich., In its construction the makers have endeavored to impart to their runabout all the staunchness, excellent workmanship, and trustworthiness of the seven-passenger touring car. The four-cylinder engine is of 20 horse-power, with four cylinders having a stroke of 3⅜ inches and a bore of 3¼ inches. Water cooling is employed. The transmission is of the selective sliding gear type. The multiple disk clutch runs in oil. The rear axle is shaft driven. There are two foot brakes and two emergency brakes. A Bosch high-tension magneto is provided.

Something new in the Garden show is to be found in nearly every one of the models exhibited. Some of the new points of interest are found in axles, transmissions, and in lubricating systems. In bodies, a type that seems to be gaining favor is the four-passenger surrey, which is but a tonneau without doors, built low in the back and sides, yet providing plenty of seating space. The cars at the Garden show range from the costliest on the market down to the little runabout that is cheap enough for anyone.

In 1901, Mr. Byron J. Carter, then of Jackson, Mich., realizing the shortcomings of geared transmissions as used in automobiles, began experiments for improvements, being naturally attracted to the friction system because of its manifest advantages. After months of careful research, the first Cartercar friction-driven automobile appeared in the summer of 1903. This automobile was of the runabout type, and in addition to the radical improvement in transmission parts, was well designed and constructed. The car has run more than 25,000 miles, and is now, without repairs, apparently in condition for additional service.

A remarkable car has been brought out by the Schacht Manufacturing Company, of Cincinnati, Ohio. The car in question is ingeniously convertible. Ordinarily it is a runabout. By the addition of a surrey seat the runabout is transformed into a four-passenger family car. The same runabout, by the employment of a special box back, is converted into a light delivery car. The vehicle is illustrated on the double page of cars appearing in this issue.

The present four-cylinder Cartercar may be regarded as an improvement of the former two-cylinder model, without a single radical change. This car will appear in the coming season in two sizes. Both have the Carter friction transmission, the nucleus around which the first Cartercar was built.

The most grueling sort of endurance contest in which motor cars have participated are 24-hour races. As a rule out of about fifteen cars starting in these events only five of them finish at all, the remainder breaking down in the course of the contest from some mechanical weakness. Some cars have started in eight or more of these terrific grinds and have never finished once. At the 24-hour race held at the A. Y. P. Exposition at Seattle, a Hudson "Twenty" stock car swept around the course for hours at a time making mile after mile with the utmost consistency in a 1:15 clip. The construction of this car is interesting, when its low selling price is considered. The rear axle is of the semi-floating type, shaft driven, and is strongly reinforced at the points where the greatest shocks and strains occur. Two large double-acting brakes are provided at each end of the rear axle. The car is built for the man who is satisfied with a speed of 55 miles an hour. The motor, four-cylinder vertical, water cooled, is simple, very strong, and amply powerful. The transmission is the three-speed sliding gear selective type used on all standard cars.

Official Meteorological Summary, New York, N. Y., December, 1909.

Atmospheric pressure: Highest, 30.49; lowest, 28.97; mean, 29.92. Temperature: Highest, 54, date, 6th; lowest, 6, date, 30th; mean of warmest day, 45; date, 6th; coolest day, 11.5; date, 30th; mean of maximum for the month, 36.8; mean of minimum, 26.1; absolute mean, 31.4; normal, 34.1; deficiency compared with the mean of 39 years, 2.7. Warmest mean temperature of December, 42, in 1891; coolest mean, 25, in 1876. Absolute maximum and minimum of December for 39 years, 68 and —6. Average daily excess since January 1st, 0.7. Precipitation: 5.00; greatest in 24 hours, 2.93; date, 13th, 14th; average for December for 39 years, 3.43. Accumulated deficiency since January 1st, 2.87. Greatest precipitation, 6.66, in 1884; least, 0.95, in 1877. Wind: Prevailing direction, west; total movement, 11,964 miles; average hourly velocity, 16.1; maximum velocity, 58 miles per hour. Weather: Clear days, 14; partly cloudy, 8; cloudy, 9; on which 0.01 or more of precipitation occurred, 6. Sleet, 13th. Snow-fall 11.4.

Many an inventor has probably wondered whether the patent law forbids his experimenting with a patented invention. The answer is: It all depends upon the character of the experiment. Suppose that an inventor is interested in flying machines, and that his primary object is to improve the Wright machine. Has he the privilege of building a Wright machine himself and flying it, in order to study its performance as well as to acquaint himself with the art of flying? We think not. He has no right to *build* the machine for the purpose of learning how to fly or for studying its performance in any way. Had he *bought* the machine from the Wright brothers or their licensees he would undoubtedly have the right to use the machine in that way.

1910 Registrations and Licenses.

Inasmuch as considerable doubt, and in some cases confusion, seems to arise in regard to the 1910 registrations and licenses in different States, the Bureau of Tours of the Automobile Club of America has issued a chart showing just what States require registration or license for the new year, where renewals are necessary, and where the old registration or license is still operative. A synopsis of this chart for New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, and Rhode Island is as follows:

New York.—Registration of cars in New York State are perpetual on the car originally registered. If car changes ownership, the new owner must re-register same. If new car is purchased, same must be registered. Transfers are not made.

New Jersey.—Registration of car and driving license is required annually, and same can be procured direct from the Bureau of Tours of the Club.

Pennsylvania.—Pennsylvania requires both registration of car and driving license annually, application blanks for which can be procured from the Bureau of Tours. Non-residents, of States that reciprocate, are allowed ten days' exemption from registration.

Massachusetts.—Registration required annually; also driving license for owner and chauffeur. Owner's driving license perpetual; chauffeur's driving license good for one year from date of issue—the latter renewed for 50 cents. Non-residents exempt for seven successive days. Non-resident owners may drive, but chauffeurs must procure driving license. The Bureau of Tours can procure temporary driving license for non-resident chauffeurs, provided chauffeur can procure certificates of good character and recommendations.

Connecticut.—Registrations are annual, expiring December 31st. Annual driving license required by owner or chauffeur. Non-residents exempt for ten days from registration and driving licenses.

Rhode Island.—Registration and driving license required. Fees of registration based upon horse-power. Non-residents duly registered in home State are exempt for ten days.

Electron—A Metal Lighter than Aluminium.

According to Kosmos, a technical review appearing at Pforzheim, the Griesheim-Electron works exhibited at the aeronautic exposition at Frankfort-on-the-Main its novel patented alloy, the metal "electron," which is claimed to be much lighter than aluminium and at the same time much more durable.

The lightest metal employed for technical purposes up to the present time has been aluminium and some alloys of aluminium, the strength and the durability of which are however lower than those of the new metal. The density of aluminium and its alloys has been nearly 3, and they are about twice as heavy as electron. The chemical works of Griesheim-Electron has discovered that magnesia is utilizable for technical purposes. By the admixture of magnesia, the price of which is comparatively low, with one or two metals, an alloy is produced of a density of 1.75 to 2, possessing great solidity, strength, and elasticity, and at the same time readily workable. The color of these alloys resembles that of silver, and they possess great sonorous quality.

The new metal is said to behave very well as regards change of temperature, and it responds to all technical requirements; in the air it becomes covered with a coating of protective oxide. As cast metal, it offers a resistance up to 18 kilogrammes per square millimeter and has at the same time an extension capacity up to 5 per cent. By the processes of condensation, such as compression, rolling, etc., the physical properties of this metal, e. g., strength and elasticity, can be materially improved without its density being increased to any considerable extent. We may thus obtain a tensile resistance up to 35 kilogrammes per square millimeter, and an extension capacity as high as 18 per cent.

By varying the quantity of metal in the alloy and the method of using it, the quantities of electron may be varied within very wide limits. The uses of the metal are therefore very numerous. It is particularly desirable where the object is to obtain extreme lightness and at the same time great strength. The physical properties of the metal electron are claimed to be superior to those of aluminium; the proportionate quantity necessary for technical purposes is 60 per cent or more, compared with the weight of aluminium.

It is anticipated that electron will prove exceedingly useful in the construction of airships and automobiles inasmuch as in most of its properties it is superior to aluminium and its alloys. In manufacturing the same object, one would require at least 40 per cent less of electron than of aluminium.

The "Zeppelin" airship requires 6,000 kilogrammes of aluminium, which could be replaced by 3,500 kilogrammes of electron. A large automobile contains, in its mechanism, about 600 kilogrammes of aluminium, which could be replaced, according to the statements of the exhibitors, by 125 kilogrammes of electron.

THE MOTOR CAR AND THE ROAD.

(*Continued from page 47.*)

permanent binders include the petroleums containing an asphaltic base, the residues of such petroleums, the heavy tars, pitches, and numerous oil, tar, and asphalt preparations. In addition to these, a few special materials have been the subject of experiment, such, for example, as the waste product from the beet and cane sugar factories. In some instances glue and bichromate of potash have been added to oil or tar emulsions to cause the residue upon the road surface to harden after the volatile products have evaporated. Waste sulphite liquors from wood pulp have been employed with some success in a concentrated form, and, in fact, the list might be indefinitely extended. The essential requisite in a dust preventive is its binding power, and it naturally follows that the experiments will cover a wide field.

Water, while usually the most abundant and cheapest material, is very often, because of the frequency with which it must be applied, the most expensive to use. Its binding power is almost entirely due to capillarity. The value of the salt solutions commonly used lies in the hygroscopic character of the dissolved salt, which, having considerable affinity for water, keeps the road surface in a moist condition long after a surface treated with water alone would have become dry through evaporation. The light oils and tars, as well as the oil and tar emulsions, are dependent for their effect upon the retention by the road surface of a comparatively small amount of true binding base after the volatile products have evaporated. This base proves effective only as long as it retains its binding power. When the binding power is destroyed, it is necessary to apply more material. If the base is an exceptionally good one, the accumulated products finally harden the road surface and prevent wear to some extent.

The heavy oils and tars differ from the lighter products in that they contain a much greater amount of asphaltum, which constitutes the binding base. The results are, therefore, of a more lasting character, and hence the name permanent binders. The semi-solid and solid preparations usually contain a still greater amount of binder. With some few exceptions, all of the true binders are bitumens, and these bitumens may be either natural or artificial.

The usual method of applying these materials to the road surface is by sprinkling. The temporary binders can usually be applied cold, but the permanent binders, because of their much greater viscosity, must be heated until sufficiently fluid. In England and France the use of coal tar is practised to a large extent and their methods of application have been highly developed. Machines are in general use which are self-propelling and in which the tar is heated and then applied to the road surface as a spray under high pressure. These so-called "tar sprayers" are not only very economical in the use of tar, but insure a more even distribution and better penetration of the road surface than it is possible to obtain in almost any other way.

In the construction of dustless roads, the crucial question is that of cost. Automobiles have but little destructive effect on pavements, but these are in general too costly for country roads. The effort must be to develop a form of construction which will withstand fast automobile traffic and at the same time be within the financial resources of the community. This is largely being done at present by the use of a bituminous binder instead of the rock dust. The two methods generally employed are known as the penetration and the mixing method. In the former, the hot liquid binder is sprinkled or sprayed over the stone and allowed to penetrate through the voids and coat the stones usually to a depth of two or three inches. Some of the devices in use force the binder into the road surface by means of heavy air pressure. In the mixing method, the stones and binder are thoroughly mixed, either by hand or machine, so that each stone is covered with a thin film of the binder. This method in general insures the better and more even distribution of the binder throughout the road surface.

The material used for the binder varies very largely with different sections. In England and France the tars are used very largely. In the western portion of the United States, the heavy asphaltic oils of California are used almost exclusively, while in other sections we find that tars, residuum oils, liquid asphalts and various proprietary compounds are being used.

One of the chief causes of the great number of failures which have been recorded in the use of bituminous road materials is the failure of the user, as well as manufacturer, to understand certain fundamental principles. To many, a tar is simply a tar and oil an oil, while in reality there is a vast difference sometimes even in the tars produced at the same works. The oils also range from those of a paraffine base to those almost wholly asphaltic. Thus a concise knowledge of the character of the product, the process followed in its preparation, and the effect which varying conditions will have upon it is necessary in order to avoid costly mistakes.

"Here is a "Big Car" the wealthiest man will be proud to own—and the man of moderate means can afford to maintain."
Benj Briscoe PREST.
"Maxwell"
The Aristocrat of Moderate Priced Cars

"This Car Can Be Run 5,000 Miles a Year at an Average Total Cost of $3.98 a week"

Here is a Big Touring Car that will interest thousands of men who have always considered an automobile beyond their means—not because they couldn't afford to buy one, but because they have felt they couldn't afford the cost of maintaining one. It is true that the expensive "up-keep" of most automobiles has put them beyond the reach of men with moderate incomes. Not so with the Maxwell. Our cars have always been the most economical to run, as over 20,700 Maxwell owners have proved. Our constant aim has been to make automobiles that the mass of the people could afford to own. We have kept right on from year to year improving Maxwells in every smallest detail that would reduce their operating expense—increasing strength and durability, decreasing weight, and simplifying construction.

Now we are satisfied that in our new 4-Cylinder, 30 H. P. Touring Car we have the great "Economy Car." What does it actually cost to run? This is what the majority of men want to know, and this is just what you don't find out about other automobiles—before you buy them.

BASED ON FACTS

When we tell you that this big, handsome Maxwell Touring car can be run 5,000 miles a year at an average total cost of $3.98 a week (or $207.08 a year) we are not theorizing. These figures include the total cost of gasoline, oil and grease required to run this car 5,000 miles; the cost of punctures; the cost of two extra tires complete (which may not be needed) and the cost of repairs. Experience shows this to be a correct average, established by Maxwell owners. How can we better show the low cost of keeping a Maxwell than by giving in dollars and cents just what 5,000 miles of motoring cost this owner? Read this letter—one of hundreds we receive unsolicited:—

"During the past season I have driven my car 5,000 miles by the odometer, averaging approximately 100 miles a week. My experience has shown that this car can be run 5,000 miles a year at an average total cost of 3.98 a week.

Gasoline	*357 Gallons*	*$65.26*
Oil	*Half barrel*	*15.00*
Grease	*Ten lbs.*	*2.00*
Punctures	*Seven*	*3.50*
Repairs		*7.40*
Two extra casings and tubes		*113.86*
		$207.02

My running cost has actually been lower than the above figures, because at the beginning of the season I bought two extra casings and tubes. As a matter of fact but one of these has been used, so that the car has cost me per week, including everything, but $3.06.

E. L. CALKINS.

NOTE:—Fac-simile of this letter sent on request.

CHEAPER THAN TROLLEYS

As these figures show, the average cost per week is but $3.98 to run this big Maxwell 100 miles. Thus making the total running cost per mile just under four cents. Do you realize that this means that you can take a family of five for an outing in this car at less expense than you could take them by trolley? To take five people for a trolley ride twenty miles out of New York and back would cost at least twenty cents each way, a total of $2.00. Five people can make a round trip in this big Maxwell touring car at a total cost of $1.60. Surprising as this statement seems, it is true, and we have included it here to furnish you with a striking example of the practical advantages of our great "Economy Car."

WE HELP YOU

Proper care is of vital importance in keeping down the cost of maintenance in any car. More automobiles are ruined from misuse than in any other way. We publish regularly, a semi-monthly magazine for Maxwell owners to show them how to run their cars as cheaply as possible. For to run this big Maxwell at the low cost above stated you must run it with proper care. In giving the above figures we have tried to be broad-minded enough not to attempt to fool ourselves. We do not guarantee that everyone can run this Maxwell at the above stated cost—though many Maxwell owners do even better. What we do want to show is that here is an automobile that thousands of people can afford to own, and to give average figures, showing what it costs to run it—exclusive of depreciation, of course.

These Books Free We want to send without cost to you, a copy of our magazine "The Co-Operator"—"How to judge an Automobile"—a practical treatise on motor cars. Our latest catalog describing and picturing every car we manufacture, together with other interesting booklets of facts. One of these booklets giving the details of the 10,000-mile run made by a Maxwell last year without stopping its engine. This is a world's record that has never been equalled by any car at any price. These books will be sent by return mail without cost to you—just say—**mail books.**

MAXWELLS IN USE TODAY 20,784.

MAXWELL-BRISCOE MOTOR CO.

DEW STREET, TARRYTOWN, N. Y.

Pawtucket, R. I. Providence, R. I. Kingsland Point, N. Y. New Castle, Ind.

Licensed under Selden Patent

THE MIDDLE WEST AND THE AUTOMOBILE INDUSTRY.

(*Continued from page 48.*)

that the freight has usually been added to the purchase price of the car, and has gone against the consumer, there are many cases in the past, and there will be many more in future, where the cars are sold directly at the catalogue price. For that reason, the location of factories in the middle West was ideal, for it is in truth the center of the automobile-buying public.

In some cases, cities have been made over and their population doubled and trebled by big motor-car factories, as in the case of Flint, Mich., and New Castle, Ind. Such cities have had a tremendous boom in real estate, and in business generally, owing to the influx of 2,000 to 5,000 families, and have assumed an entirely different position on the map because motor-car factories were established within their limits. Besides supplying employment to laborers in large numbers, much money has been made by the leaders in the various enterprises. This has been especially true among the makers of wheels, tires, frames, and other parts. In a general way, it may be said that the parts makers have made more money than the automobile builders, as the latter have expended greater sums of money in experimenting.

The total capital of the automobile manufacturers in this country is about $225,000,000. The actual value of the plants will run into some extraordinary figures, and these values are rapidly increasing. As for the output for 1910, it is likely to exceed 200,000 cars, although there may be a slight falling off from these figures, owing to the inability of parts makers to supply the demand. There are now about 150,000 automobiles in use in this country. In a general way, it may be said that the employees number some 120,000 in motor-car factories, with employees in parts factories reaching not less than 40,000, a total of 160,000. America may be safely considered the home of the low-priced car, a condition brought about by the tremendous buying power of the middle classes, who demand a car which can be cared for by the owner without the aid of an expensive chauffeur.

These low-priced cars have been made possible by ideal factory methods and big production. This necessitated their being standardized, something that may be said to be original with the American maker, who feels that any one of ten thousand parts should be made to fit any one car turned out by his company.

By working on big productions and

THE KNOBS WILL STOP YOUR SKIDDING

MORGAN & WRIGHT QUICK DETACHABLE CLINCHER
INFLATE TO 100 LBS AIR PRESSURE
THE
MORGAN & WRIGHT
NOBBY TREAD
a new non-skid tire designed and made by Morgan & Wright, makers of "Good Tires." As a safeguard against skidding and drive-slipping, it has never been approached in non-skid tire construction.
The big, thick knobs, made of the toughest rubber it is possible to produce, grip the road like a magnet and prevent side slips or drive slips even on wet asphalt pavements or roads covered with snow or ice.
It has passed the experimental stage. Reports from all sections show that not only in effectiveness, but also in wearing quality it is vastly superior to the existing styles of non-skid tires.
The broad knobs expose nearly as much surface to the wear of the road as a plain tread, and consequently wear down little if any faster.
Made of a white rubber stock, it is by odds the "classiest" looking tire on the market, and will add an up-to-the-minute finish to any car to which it is equipped.

MORGAN & WRIGHT NOBBY TREAD TIRE

MORGAN & WRIGHT, DETROIT

BRANCHES, AGENCIES OR DEALERS EVERYWHERE

keeping prices down, there is little doubt that the American maker will sooner or later figure in the foreign trade. This is particularly true in connection with the small, medium-priced car, a field that has been neglected by the foreigners. With the rapid growth of the business there have been developed many new captains of industry, who as pioneers have blazed the way for motor-car trade, and who are certain to be important factors in future industrial life.

The Modern Electric Automobile.

(Continued from page 51.)

current consumption. This arrangement is necessary to keep any excessive rush of current at any tire away from the battery. Nothing is more detrimental to the capacity and the life of the battery. A rapid increase of current flow and speed from step to step will result in a jerking action in the whole driving mechanism, which of course means rapid wear and possible breakage of the driving parts. It is easier to break a string with a short jerk than with an even, smooth pull.

The limited power carried in one charge of the battery has forced the designer of electric carriages to avoid as far as possible all losses due to friction in the method of transmission of the power from the motor to the wheels as well as in the bearings. The high-speed motor, with its advantage of light weight and high efficiency in starting and in climbing hills, necessitates, in the most approved methods of construction, a double reduction of speed. This means that the motive power is first transmitted with a reduction of speed to a countershaft, and then to the rear axle. The first reduction of the countershaft is accomplished in different ways and with varying success. The earlier carriages used metal spur gears for this purpose, but they proved to be unsatisfactory on account of their noisy running and great loss of power. It may be mentioned here that where there is noise there is friction, and consequently where there is friction there is loss of power. The next step of improvement was to make the one gear of compressed rawhide. A little less noise in running resulted. But this construction was still far from being perfect. After passing through the stages of worm and arrow-toothed gears, a perfect transmission was obtained when the Renold silent chain was introduced. This chain is self-adjustable to pitch after wear. In flexibility and high efficiency, it is an ideal, high-speed transmission device. It is found to-day on every high-grade electric car. If kept in proper alignment and well adjusted, the life of this chain is indefinite. To receive the best service, it must be dust-proof, incased, and kept well lubricated.

The power is transmitted from countershaft to the rear wheels on all up-to-date machines by means of roller chains or through a shaft and bevel gears. The advantage of one type over the other has been much disputed. The greatest objection to the roller chains is their noisy running, their rapid wear, their exposure to dirt and dust, and their loss in efficiency after wear. Some reasons for the superiority of the shaft and bevel gear transmission are its quietness, its cleanliness, its long life, and its increased efficiency after use. Its durability is due to the fact that the bevel gears run permanently in oil and that they are incased. Moreover, the shaft drive does not require any adjustment, and when well designed, all parts of the running gear and power plant will stay in absolute alignment. The necessary adjustment of the double chain drive will soon create a variation in the distance from the front to the rear axle on both sides; for two chains will never stretch alike. This disadvantage will affect the steering, decrease the life of the tires, and result in a loss of power. If the chain sprockets are not in proper alignment after adjustment the chains will rub sidewise on the sprockets, which will, of course, shorten the life of the transmission and result in a loss of efficiency.

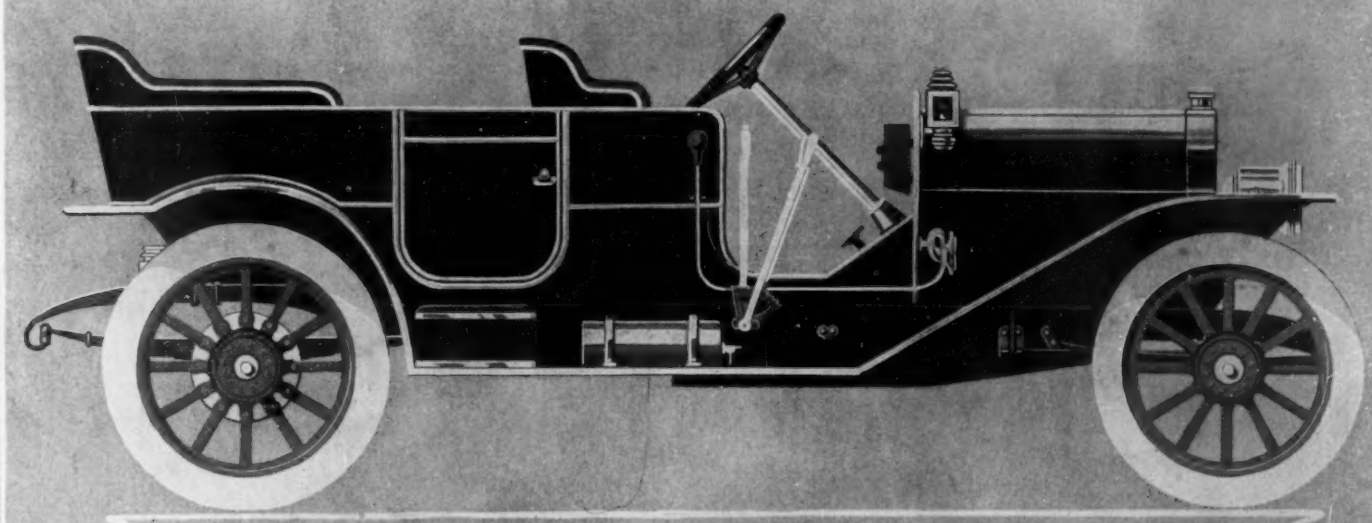
It would be very interesting to measure the distance of both axles on either side of double chain-driven cars after they have been in service in the hands of the average driver and under the care of the average garage for several months to find out if the axles are still parallel. Absence of friction is an absolutely necessary factor in the construction of electric automobiles. For this reason the proper type of bearings must be applied to the motor, countershaft, and wheels. The ball bearing, the highest achievement in bearing construction, has proven to be superior to any other type, and will be found to-day in any high-grade automobile. Once properly packed with grease this bearing will not require any attention for several thousand miles; if proper sizes for the load to be carried are selected, no wear can be noticed.

Every electric carriage should be equipped with reliable brakes. It is important that they should stop the car going forward as well as backward. It is not the number of brakes with which a car is equipped, but their efficiency, which insures safety. Most modern cars are equipped with one of two types; namely, the external brake in which a steel band surrounds the drum either on the motor shaft or on the rear wheels, or the internal expanding brake attached to the rear wheels, which is commonly used and generally preferred. In this construction two brake shoes are fixed inside a drum. A small movement of the brake lever will cause the brake shoes to open out against the inside surface of the drum. The braking action should be applied at the rear wheels. All brakes attached to the motor, if used frequently, are detrimental to the motor and the transmission system. For this reason also, the electric brake, which seemed in older days to be inseparable from any electric vehicle, is condemned by the modern designer of electric conveyances. Even on the heavy electric street car it had to give room, on this account, to the air brake. In many brakes the shoes or bands are operated through flexible steel cords, which is not the best arrangement. A system of steel rods is to be preferred. In case two brakes are operated by a lever, a balancing bar should be inserted in the system to insure equal pressure on both brakes.

Tires influence the performance of an electric automobile more than may be imagined. Various designs of tires show a variation of up to fifty per cent in efficiency, so that the speed per single charge of the battery is affected. Special points to be borne in mind in the care of pneumatic tires are that rust as well as oil is very detrimental to them, and that it is necessary to keep tires well inflated.

If the storage battery of a few years ago be compared with the up to-date battery, it will be found that a very much decreased weight with a large increase in capacity and durability has been obtained.

The various wire connections on an electric car should be laid with care, and the wire sizes should be large enough to carry the heaviest possible loads without loss of power. As far as possible, all leads should be carried directly from the battery to the controller, and then to the motor, and all connections should be tight and securely locked. One common fault in early cars was the loose hanging wires running in different directions, without any attempt at a methodical arrangement. Good insulation is necessary. Because it is able to resist acid, weather, and mechanical strain, rubber of good quality and sufficient size has proven to be the best material for this purpose.



The Springfield

Here is a Special Car for a few Select Buyers

Price, for either Standard Touring or Torpedo Bodies **$2500**

ABOUT three hundred prospective purchasers who have it in mind to pay from four to five thousand dollars can "get in" on this made-to-order Springfield for 1910.

For the past three years a limited number of these cars (about 100 each year) have been made for special buyers, who have desired certain features in their cars not to be found in any cars on the market regardless of price.

Hence the Springfield has come to be known as the "made-to-order" car.

Until this year no attempt has been made to manufacture more than the few cars, which were easily sold by private sale to the class of buyers to whom a car of this character appeals.

For this reason practically no advertising has ever appeared concerning the Springfield.

This year, however, we have increased our facilities, and hope to be able to supply in the neighborhood of **three hundred cars.**

The fact that we **manufacture** practically every part that enters into the Springfield makes it impossible (even if we were so inclined) to make them in the quantities possible with an assembled car.

No apology is made for the low price we have placed upon the car. This price enables us to supply the best material of every kind it is possible to buy, and in addition gives us a fair profit.

We are willing to let the specifications speak for the **quality** of material used and the general character of the car.

The automobile dealer, familiar with all makes, will immediately recognize in these specifications and the accompanying illustrations an automobile of the strict de-luxe type—a car of the character that will always have a ready sale among those who are in a position to buy the **best** cars.

SPECIFICATIONS:

MOTOR—Four cylinder, vertical, water cooled, 5 inch bore, 4¾ inch stroke.

VALVES—All on one side, interchangeable; operated by single cam shaft with cams integral with shaft, and mounted on Annular Ball Bearings. Idler Gear, Pump and magneto shaft mounted on genuine imported Annular Ball Bearings.

TRANSMISSION—Selective type, sliding gear, three speeds forward and reverse; mounted on genuine imported F. & S. Annular Ball Bearings. All gears and shafts of heat-treated Chrome Vanadium Steel.

REAR AXLE—One piece seamless drawn Chrome Vanadium Steel housing of the clutch driven floating type. Gears and shafts Chrome Vanadium Steel, heat treated, mounted on genuine imported Annular Ball Bearings.

FRONT AXLE—Special I-beam drop forged in one piece, of heat-treated Chrome Vanadium Steel, with ball bearing steering knuckle.

FRAME—Pressed steel, reinforced.

SPRINGS—Vanadium steel, semi-elliptic front, three-quarter elliptic rear

IGNITION—Jump spark, 4-unit coil on dash, storage battery, double system with genuine Type D-4 Bosch magneto; two spark plugs in each cylinder.

LUBRICATION—Positive, automatic oil system enclosed in crank case of motor.

DRIVE—Shaft, with large bevel gears of heat treated Chrome Vanadium Steel.

BRAKES—Two independent systems, internal expanding type. Raybestos faced. Foot brake 14 inches in diameter; operated by cam arrangement.

BODY—Straight line, five or seven passenger, sheet metal and upholstered in genuine hand buffed leather.

TIRES—36 x 5 inches rear 36 x 4 inches front; Quick Detachable rims.

STEERING GEAR—Irreversible, 18 inch wheel; controlling mechanism on top of wheel.

GASOLINE CAPACITY—Twenty gallons under front seat.

MUFFLER—Our own construction, free and silent, with no back pressure.

RADIATOR—Latest design, genuine honeycomb type; very large and efficient.

CARBURETOR—Stromberg, float feed type, auxiliary air valve and water jacketed.

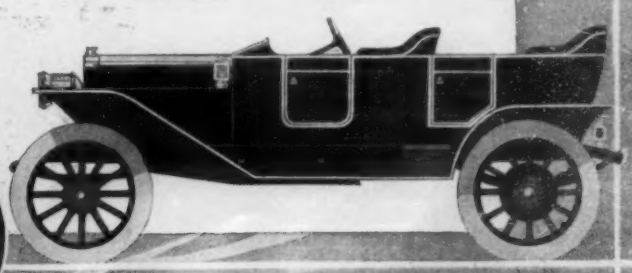
CLUTCH—Large cone type with ball thrust bearings. Simple means of spring adjustment.

WHEEL BASE—128 inches.
TREAD—56½ inches.
GEAR RATIO—3:1.
CLEARANCE—10 inches.
COLOR—Greens, grays, blues, maroons, yellows, etc.
WEIGHT—2,900 pounds.
EQUIPMENT—Two gas and three oil lamps, generator, horn, jack, tire and repair tools.
PRICE—$2,500.

Correspondence Solicited

The Springfield Motor Car Company

311 Monroe Street
SPRINGFIELD, ILL.



HOW TO OVERHAUL A CAR.

(*Continued from page 53.*)

son for this is that the shafts, especially gear shafts, wear down and must be ground true; and no manufacturers seem to appreciate the usefulness of boring repair bushings slightly under size. The pilot bushing, being solid, must be specially made to suit the shaft. Aside from this one, a skillful amateur can make a good job of scraping his own bushings if he has a suitable set of scrapers and time and patience. Red lead is used to test the fit. Of course the gear case must come out of the car, and at intervals the bushing caps are bolted down tight and the shaft turned to determine whether it is tight or free, and whether it makes contact all over.

In refitting gear shafts and bushings it is necessary not only to achieve a proper fit, but to keep the shafts absolutely parallel. If they are not, the gear teeth will not bear squarely across their face, but will wear away at their corners, as exaggerated in the dotted portions, Fig. 4.

In the matter of gear replacements the best result is naturally gained by replacing both mating gears if either is badly worn, since otherwise the new gear would have to run against a bad profile and would wear away sooner. If the car has side chain drive, the differential shaft bushings will need refitting at the same time. The parts of a differential which wear fastest are the bushings *A* of the spur or bevel pinions *B* (Fig. 5), since these are the hardest things to lubricate. To take the differential apart it may be necessary to file the ends of headed-over through-bolts holding it together. In that case the nuts should be reduced in thickness so that the bolts can be headed over again on reassembling. (The bolts in Fig. 5 do not go through.) It is very important not to give anything about the differential the slightest chance of working loose, and the same applies to the bolts holding the change gears. Another point that is difficult to oil, and therefore liable to cut, is the bearing *C* between the differential or gear hub and the sleeve into which the hub of the differential shell extends. This sleeve runs in plain or ball bearings in the case, with the shaft or gear hub turning inside of it whenever the car goes around a turn. Sooner or later new bushings are needed.

If oil is used in the gear case, as it must be if plain bushings are used instead of ball bearings, it becomes something of a problem to lubricate the bearings effectively without excessive leakage of oil. The writer solders a thin wire gauze screen (Fig. 6) over the interior oil pockets to exclude steel grit worn from the gears. In order to prevent escape of oil from the ends of the bushings a felt ring is necessary (Fig. 6). This ring would cause the oil near it to become stagnant were it not for a special oil groove *B*, which should be chipped entirely around the bushing and connect with a groove *C* by which oil entering it may return to the interior of the case. But for this provision particles of dirt getting into the end of the bearing would accumulate and cut the shaft.

In the rear axle of a shaft-driven car the thing most likely to need replacement is the differential. There are various ways of getting at it, depending on the design of the axle casing. If the axle is divided vertically in the fore and aft central plane, the rear springs must be jacked up and disconnected from the axle, and the halves of the axle drawn asunder after taking off the wheels. A better arrangement is to have a removable cover plate on the casing through which the differential is inserted and withdrawn. This is found especially in axles of the floating type, with wheels running on ball or roller bearings on the ends of the axle tubes and driven by "floating" shafts extending from the differential to jaw clutch plates engaging the outer ends of the wheel hubs. To remove the differential, the hub caps are first removed and the floating shafts slipped out from the differential without jacking up; then the straps holding down the differential are removed, the bevel driving pinion withdrawn, and the differential lifted out.

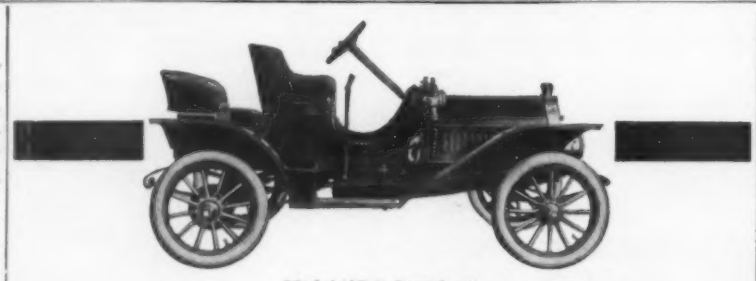
Unless a car is more than one year old it is not necessary to assume that the differential needs overhauling. By jacking up one rear wheel and rocking it back and forth, the total amount of slack in the differential may be estimated. It is also usually possible to reach the pinions through openings in the differential shell, and by shaking them to determine whether they are loose. If so, they should be rebushed and the pins or spider replaced if worn. Frequently means are provided for advancing slightly the driving pinion or gear or both to compensate for wear. If this adjustment is disturbed the gears should be moved in a straight line and not canted around; else the teeth will engage only at their small or large ends instead of over their full length. By rubbing red lead on the teeth and turning the gears, one can tell where the teeth touch.

If cup and cone ball bearings are used, whether in the rear axle or in the transmission, any worn parts should be renewed immediately. Fig. 7 shows the effect of wear on a stationary ball cone, e. g., on an axle spindle. The pressure comes against the stationary bottom portion, and, while the cup wears a true path, the cone is destroyed. It is possible, though not always worth while, to prolong the life of the cone by giving it a quarter or half turn on the shaft or axle. If the cup is stationary and the cone rotates, evidently the cup will be the first to wear out of round. When one ball of a set is renewed the entire set should be replaced with it.

We come now to the engine, the last and in some ways the most difficult part to overhaul. The owner is strongly advised not to attempt to refit the main crank shaft bearings, unless he has had considerable previous experience and knows exactly what to do. On the other hand it is not at all hard to regrind and readjust valves, replace worn valve lifters and their guides, and to do ordinary tinkering and adjusting with the timer, carbureter, etc. It is best not to tamper with the magneto further than to clean the interrupter and adjust the interrupter contact points if worn.

To overhaul the engine first strip it of all small gear. Take off the magneto, first marking the coupling so that it can be replaced exactly as it was, and tag the wires. Remove and tag the oil pipes, blow through them to see that they are clear, and plug them to exclude dirt. Disconnect the carbureter, remove the timer, take out the spark plugs and plug the holes with waste, remove the dust pan, take out and mark the valves; take off the water pipes, the pump, and the fan. Now take off the cylinders. If no further dismantling is contemplated, the piston heads may be scraped *in situ*, taking care that none of the carbon falls into the crank case; and the piston rings are likewise cleaned without removal if possible. If the rings are leaky, as proved by failure to hold compression when the valves are tight, new rings are put in and fitted to the locating pins, which prevent them from turning. At the same time the carbon can be scraped from the inside of the cylinder heads.

Take down the oil pan. Test the fit of the wrist pin and crank pin bearings by rocking the pistons and connecting rods on the pins. Do not confuse a rocking motion due to loose fit with end play on the pins. A certain amount of end play is always provided. A crank pin bushing is likely to wear conical (see shaded area) if the rod is offset as in Fig. 8, and if the rod is springy the bushing may wear bell mouthed at both ends. The crank pin itself will in time wear flat at the point of greatest pressure, as indicated in Fig. 9. It takes more skill than can be acquired off-hand to true it up again, but it can be done with a fine



Model "R" Runabout

$680.00 Without rumble seat. With 1½ in. solid rubber tires

$700.00 With rumble seat and 1¾ inch solid rubber tires

$730.00 Without rumble seat. With pneumatic tires.

$750.00 With rumble seat and pneumatic tires.

OUR NEW 1910
MODEL "R" RUNABOUT

No car offered this season at the prices above is equal in value and service to the new Invincible Schacht Model "R" Runabout.

Choice of equipment includes in range of $680 to $750 to best suit the purchaser's requirements.

Our full line catalog includes all the celebrated line of Schacht Cars to choose from and we especially invite you to figure with our agents or with us direct before purchasing any car this year.

THE NEW 1910
INVINCIBLE SCHACHT LINE

You will appreciate the opportunity of selecting from a full line of cars, on guaranteed delivery basis, where the agent has a standard line to sell and the purchaser can pick just the car to suit his needs, at a reasonable value-received price. No such efficient, dependable, general-utility cars for town and country ready for delivery this season are equal to this line, including one of the most popular cars of the year—The New Schacht Runabout above for $680 and upward. Send your name for book containing full details and prices.

MERCHANTS' DELIVERY

Schacht Agents are prepared to promptly demonstrate our Model D, Merchants' Delivery Schacht Cars to business houses. Catalog gives full detailed descriptions and prices.

Save expense of horse delivery. Consider the figures on the side of economy and durability which we will send you.

SCHACHT MANUFACTURING COMPANY
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Please send me your Book containing full details and prices on The Invincible Schacht 1910 Line.

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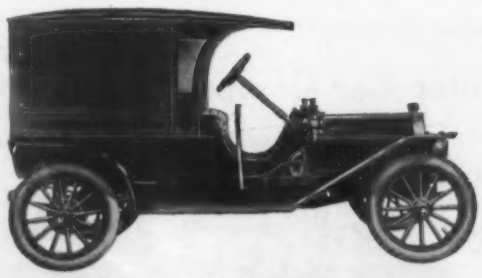


Model "D" Merchants' Delivery

Swiss file and calipers. It is not necessary to file clear around the unworn portion of the pin, since a slight deviation from its original axis does no harm, neither is it absolutely essential that it should have the same diameter throughout. Its new axis, however, must be absolutely parallel to the shaft. It is best to throw away worn bushings and put in new, taking out or inserting shims till a fit is obtained, and scraping no more than is necessary. A worn wrist pin bushing must be renewed, and usually the wrist pin must be ground true. If the crank pins are oiled through passages drilled in the crank shaft, their lubrication is probably perfect. If, however, they are oiled solely by splash and the oil holes are in the upper half of the crank pin bushing, a considerable improvement can be made by replacing the upper bushings with solid ones and introducing the oil through the bottom half by brazing a copper tube in the cap to act as an oil scoop (Fig. 10). The bottom half is then drilled and provided with an oil groove for about half its length. It is a principle of lubrication that the oil should always be introduced at the unloaded side of the journal, and that any breaks in the continuity of the loaded surface merely afford the oil an avenue of escape under pressure.

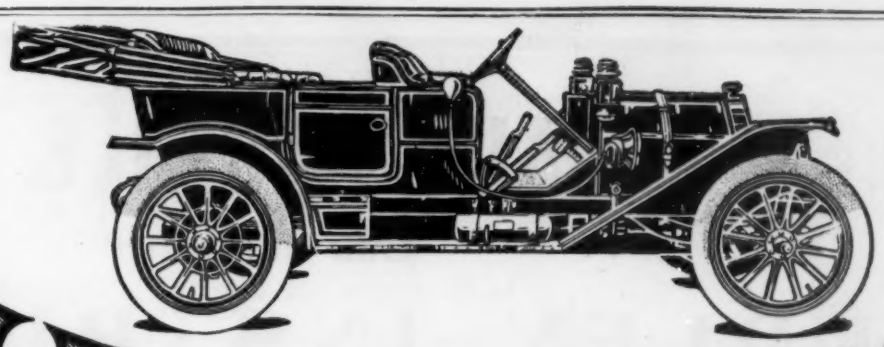
To renew the clutch leather, take off the old leather and use it as a pattern. Select the new leather carefully for uniform and correct thickness, and cut it about half an inch short. The curvature should be approximately that of the old piece (Fig. 11). Locate the end and the middle holes for the rivets, countersinking them considerably so the rivet heads will not come flush, and soak the strip in water till it has swelled sufficiently to go in place. Use the end of a steel bar as an anvil, and put in the end and middle rivets first, holding the strip meanswhile by wire nails. The riveting must be completed before the strip dries.

AUTOMOBILE FIRE-ENGINES.

(*Continued from page 55.*)

fire engine proper. After reaching the scene of the fire the driving gear is uncoupled and the pumps are put in connection with the engines. Such fire engines of course must draw their water from a hydrant, well, or other supply. They have done splendid work in suburbs wherever fire engines of suitable power or an adequate high-pressure system can be held in reserve. The best of these machines can run to a fire with a crew of seven men at speeds up to 60 miles per hour and carry 1,000 feet of hose. The pumps deliver 700 gallons of water per minute at pressures up to 150 pounds to the square inch. The regular steam fire engine has a capacity varying from 400 gallons per minute to 1,000 gallons in the case of the largest size of machines. Such a motor fire engine usually contains two 3-gallon chemical extinguishers, and heavy suction hose for hydrant connection, fire axes, nozzle holders, large alarm bell, the usual equipment of lamps, lanterns, tools, and small scaling ladders. In the opinion of many fire engineers a suburban fire station should have two such motor engines, with possibly a steam engine in reserve. Again, steam engines may also be held at reserve stations instead of a large number of single steamers. This means considerable economy in the purchase, equipment, and maintenance of a fire house, while the increased radius of action and the speed of the motors enable efficient service to be rendered.

Finally, we may consider machines in which no essential change is made in their construction except to use the gasoline motor and means of propulsion in place of the usual horses. Typical of these are the large combination hose wagons and chemical engines which carry 1,000 feet of 2½-inch fire hose and answer every purpose of the horse-drawn wagons which they are destined to supplant. Fuel for 150 miles can be carried in the gasoline tanks and speeds



HAYNES

Why You Should Buy It

Buying an automobile is serious business. Thousands have denied themselves the pleasure of motoring. They doubted the wisdom of buying an expensive car and would not take the risk of a cheap one. Perhaps you're one of them.

The new Haynes solves ***your*** problem. It was built to suit ***your*** needs. ***Our*** problem was to make just as good a car as could be built by the ***best workmen,*** from only the ***best materials.*** We wanted to give you a car that you could be proud of; one which would sustain our reputation as the pioneer builders of high-grade cars. Price was a secondary consideration; quality was our first thought. Model 19 is the result.

MODEL 19
$2,000.00
FULLY EQUIPPED
Extra Complete Outfit, Including Full Lamp Equipment, Top, Glass Front, Speedometer, All Tools, Jack and Tire-Repair Kit. (Absolutely Nothing Else To Buy.)

No better car can be built at any price, none good enough for any less. Two Thousand Dollars is the right price for the right car, and the new Haynes ***is right.***

The new Haynes embodies everything in an automobile that's worth having. It is unusually attractive in appearance; it's workmanship, mechanism and general quality are unexcelled by the highest priced foreign or domestic cars.

It's just the car to meet your requirements and keep your interest. It has no hidden weaknesses—no parts of unknown value. Every detail of its construction represents years of experiment and study; every doubtful element has been discarded.

There's no economy in sacrificing enjoyment and comfort to save a few hundred dollars in the purchase price. A cheap car may look good, and do its work well for a time, ***but it can't last.***

It costs money to build a car that will stand the test year in and year out. There's bound to be skimping somewhere in a cheap car. That means trouble for ***you*** sooner or later, and disappointment.

An automobile is one thing you would not like to apologize for. You can't afford an automobile unless you can buy a good one. No man can.

Perhaps you are willing to pay more for the car that suits you, than a new Haynes costs. But what's the use?

A better car can't be built at any price. Don't forget that. No matter what you're willing to pay, ***find out all about this Car.*** Make your own comparisons.

Take a ride in one of them. Notice the finish, the upholstery. Above all study the engine and ease of operation. There's pleasure in every mile. No matter how inexperienced, you'll appreciate the difference between this car of ***established reputation*** and other makes.

Haynes Automobile Co.
124 Main Street, Kokomo, Ind.
Please forward literature concerning your Model 19 and advise where I can have a demonstration should I desire it.
Name.....
Address.....

Mail this coupon. We will send booklet describing the details of this superior car, and tell you where you can have a demonstration.

HAYNES AUTOMOBILE CO., 124 Main St., Kokomo, Ind.
LICENSED UNDER SELDEN PATENT

Gas or Gasoline Engines ½ H.P.
Light Weight, Water Cooled, and Speed from 400 to 2000 Revolutions
Send for Circulars
BEUTEL & OTTERBEIN
120 CRYSTAL STREET, BROOKLYN, N. Y.
Designers and Builders of Special Machinery

Aeroplanes and Motors

We are building monoplanes of the Bleriot cross-channel type. Delivery 3 weeks after receipt of order. Flight guaranteed. Price $5,000; one-third cash with order.
We also build several kinds of light-weight aeronautic motors and propellers. Particulars and prices furnished upon application.
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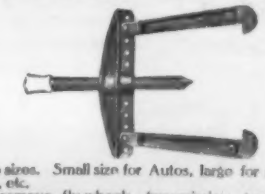

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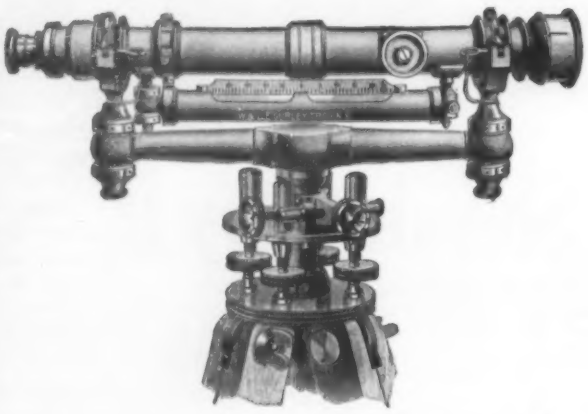

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up to 30 and 35 miles an hour with full load are easily achieved. To carry the heavy hose for the high-pressure service of New York city a special automobile wagon has been found most useful and in over a year of service has met every test. Put into use in January, 1909, it was successfully operated on snowy and slippery streets and never failed in responding to an alarm. This vehicle is built to run up to 30 miles an hour on city streets, climb any reasonable grades, and to carry the full strength of a high-pressure company. It carries forty 50-foot lengths of 3-inch heavy rubber high-pressure fire hose and has a turret nozzle mounted upon the driver's seat from which a powerful siamesed stream can be delivered. It takes the place of a three-horse wagon previously employed. In fact, this automobile truck of New York city has been the logical outcome of the high-pressure service in the lower part of Manhattan. The future will probably see it extensively used in New York and in other cities provided with high-pressure service.

Nor is the use of the automobile confined to the emergency wagons, chemical engines, combination and hose wagons. Aerial ladder trucks up to 85 feet in height are now made for motor traffic and have all the essential features of this important piece of apparatus previously requiring three horses. A useful aerial motor truck is mounted upon a 90-horse-power four-cylinder automobile, the automobile taking the place of the forward wheels, thus making a six-wheel vehicle slightly longer than the ordinary ladder truck with its horses, but steered by a tiller wheel in the rear in the same manner. The whole machine can be turned in its length around corners and is often more easily controlled and regulated than with horses, besides being capable of running 25 miles per hour with full equipment and crew on a five per cent. grade. This apparatus is of interest in comparison with the somewhat shorter ladder devices known as "escapes" which are in use in Europe and which have been developed there to considerable efficiency.

That the motor-propelled apparatus is bound to come eventually and to supplant horse-drawn machines seems to be the opinion of progressive fire fighters. Chief Croker spoke in this vein to the writer and said that it was only a matter of expense in the original outlay that prevented motor fire engines from being extensively adopted in the suburbs of the greater city. In fact during the last weeks of the past year the Fire Commissioner advertised for bids for furnishing two automobile combination gasoline engines and hose wagons for the borough of Brooklyn and one for the borough of Queens. At present the high efficiency motor fire engines cost more than steam fire engines of greater power, and as fire fighting power is desired first of all, in nearly every large city department, the chiefs prefer heavy units to increased mobility and speed. On the other hand the makers of motor fire apparatus claim that the economies of maintenance more than justify the increased expense.

There are several questions that enter into the operation of commercial motor vehicles that naturally arise in connection with fire apparatus. One is, the matter of tires, but it must be recalled that the actual mileage of fire apparatus is inconsiderable and that furthermore the best fire vehicles are now supplied with rubber tires, so that there would be no more wear in one case than in the other. Fire engines, owing to their portability and the speed with which they must be brought to full working capacity, are notoriously inefficient machines from a mechanical standpoint, and the gasoline engine in no way works for worse conditions. If reasonable economy of operation is secured as well as reliability of service, then with the extraordinary decrease in the cost of maintenance the gasoline motor-driven machine is bound to have a successful future.

ANTI JOY RIDE DEVICES.

(*Continued from page 58.*)

other parts of the car by means of attachments fastened inside the hood. For example by means of two thumbscrews through the dash, which are inaccessible until the hood is raised, the footboards can be secured against removal, and this will make it impossible to open the cover of the gear box. Furthermore, there is combined with the lock a vibration indicator to record movements of the vehicle.

Every precaution to render the device proof against tampering seems to have been taken by the inventor, who asserts that it is impossible to start the engine, open the hood, or operate the car without the owner's knowledge or consent unless he has forgotten to withdraw the key or has given a duplicate key into the possession of the chauffeur. In the latter event the chauffeur cannot take the car out on the road without having the approximate distance traveled registered by the vibration recorder.

The only visible part of the device is a polished brass plate 2 by 4 inches in size which is set into the dash. In the upper part of this is set a casting containing a compact switch for use with any system of ignition and also a Yale lock provided on its inner end with a cam plate and contact piece. The lock key takes the place of the usual switch lever, and the switch cannot be operated without it. It is also impossible to remove the key until the switch has been turned to "off" position.

Two bell-crank levers surrounding the barrel of the Yale lock behind the switch are operated by the cam plate of the lock, and their long arms are attached to small steel cables that pass through eyelets screwed into the dash under the hood. These cables lead to two special spring latches secured to the lower inner corners of the dash in a position to engage the slots cut in strips of angle iron riveted to the inside of the hood on either side. Thus, when the key and cam are in open position, as shown in the drawing, the latches are withdrawn and the hood can be raised, but when the switch has been turned to "off" and the key removed, the latches are released and hold the hood against all attempts to raise it. The engines may be run with the hood open, and the hood will lock automatically when closed.

In a special recess directly beneath the Yale lock is placed a vibration recorder, resembling a pedometer in appearance and action, which is held securely by a plate provided with a spring to press against the back of the instrument. The vibration recorder is so adjusted that it will not be affected by the running of the engine while the car is at rest; but will record the vibrations of the car when in motion. The plate is sealed by a wire and lead seal and also by a strip of paper pasted across the back with the owner's name written thereon, and if these seals are broken explanations from the chauffeur are in order, as he is the only person except the owner who has access to the hood chamber. The switch can be removed without disturbing the sealed chamber holding the recorder, but only after the hood has been raised. It is impossible to remove any part of the mechanism from the exposed side of the dash.

MAKING YOUR OWN REPAIRS.

(*Continued from page 62.*)

graphite, and in order to apply it, the springs must be relieved of the weight of the car. To do this, appiy jacks to the corners of the frame, and operate them until the tires are clear of the ground. The weight of the axles and wheels will

(*Continued on page 72.*)

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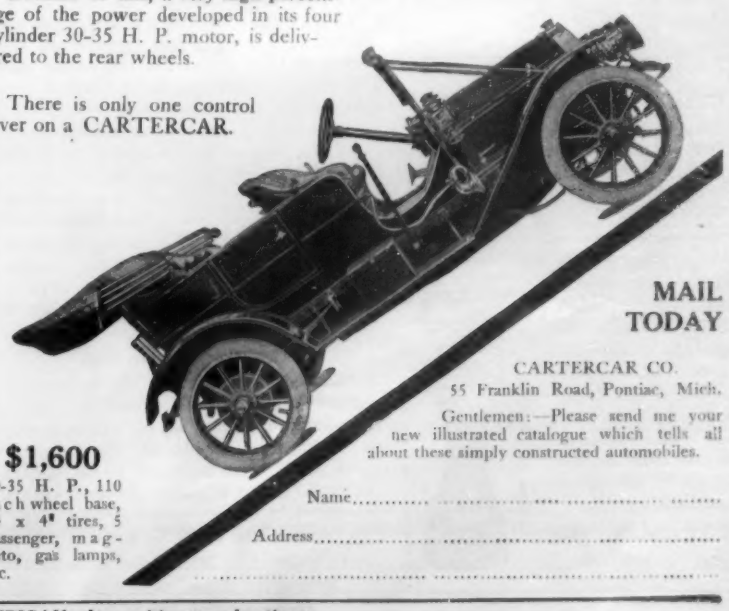

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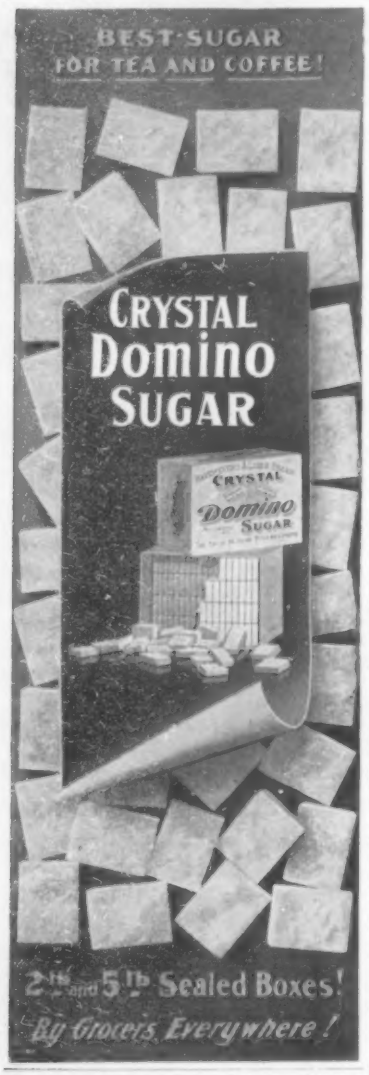

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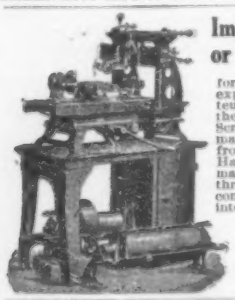

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(*Continued from page 70.*)

then be suspended from the springs, and in almost all cases it will cause the leaves to separate sufficiently to permit the lubricant to be introduced by means of a thin-bladded table knife.

CLEANING THE OILING SYSTEM.

It occasionally happens that the oiling system becomes clogged, either from the thickening of the oil or the introduction of dirt and grit.

In the majority of cases this may be cleared away by draining the oil from the tank and crank case, putting a pint or two of gasoline into the tank, and cranking the engine briskly. The gasoline will thus be forced through all parts of the system, and will cut out the thick oil and dirt. Before refilling the tank with oil, the gasoline should be drained out and time allowed for it to drip out of the piping.

CUTTING A GASKET.

To prevent the leakage of oil the cover of a gear case usually rests on a gasket, which may easily be injured or destroyed when the cover is removed. Its shape makes it seem a difficult part to replace, but as a matter of fact it is a question of only a few minutes work to replace it.

The material to use is smooth and uncreased brown wrapping paper of medium weight, and of a surface that is not too highly glazed. Clean the top of the gear box, and lay the paper over it; then with a light hammer tap the paper where it rests on the outer edge of the flat part. The edge cuts through the paper where the hammer strikes, and to get the gasket to proper shape it is only necessary to follow the edge all around. To prevent the slipping of the paper, the first step might well be to cut two bolt holes through it, and to insert the bolts. The holes are cut by striking the paper over the bolt holes in the gear case, using the ball end of the hammer.

The inside opening is cut in the same manner as the outside. Before applying the gasket, give one side a coat of red lead and the other a coat of shellac, and in placing it in position have the shellac side down, or in contact with the stationary part. The gasket will then cling, and will not be torn on any subsequent removal of the cover.

A gasket made in this way will give excellent results under the detachable head of a marine or stationary engine, but after fitting it the engine should be run sufficiently to get normally heated before finally setting up the nuts or bolts that secure the head to the cylinder.

TO REMOVE A DENT.

Aside from its unsightliness, a dent in a tube, radiator housing or other metal part may interfere with operation, and it becomes necessary to remove it. To do this, form one end of a piece of stout copper wire into a loop, and solder it to the lowest point of the dent. Then exert a strong and steady pull on the wire, at the same time tapping the borders of the dent with a light hammer. When the dent is thus pulled out the solder may be melted off and the finish restored with fine emery and crocus cloth.

A dent in a gasoline tank is more difficult to remove, on account of the greater stiffness of the metal, but it may be accomplished by the use of a discarded valve. Clean the valve head with emery cloth and solder it, not to the bottom of the dent, but to one of the sloping sides. The valve stem then forms a sort of lever by which the dent may be pried out.

REPAIRING A SPLIT TUBE.

The copper and brass piping used for gasoline and water connections has a tendency to split, and an injury of this sort apparently calls for a renewal of the part. This, however, is not always necessary, for a permanent and sightly repair is a comparatively simple matter.

The work is begun by winding No. 14 soft copper wire around the split portion of the pipe, and a half-inch beyond each end. Then, after heating and applying soldering solution, the windings should be soldered together and the outside windings soldered to the tube. This will form a tight jacket around the split portion of the tube, and will save the very considerable expense of a new part.

LINING UP THE WHEELS.

While it is not generally realized, yet it is none the less true that the failure of tires to give good service is in many cases due to the wheels being out of line. This may be caused by misadjustment, sprung steering-rod or arms, a twist in the axle from road shocks, all of which result in throwing the wheels out of parallel with the center line of the car. If the wheels are set correctly, they will have a true rolling motion on the road, and the slightest deviation from this position will set up an additional sliding action that is destructive to the tire surfaces.

In testing the parallelism of the wheels it may be taken for granted that the side members of the frame, as well as the springs, are parallel. Starting with a rear wheel, measurements should be made of the distances between the spring and the forward and rear portions of the felloe, at points as nearly as possible on the level of the axle. These measurements should be equal, and should be the same as corresponding measurements made on the opposite side of the car. If the figures indicate that the wheels are equally out of parallel with the springs, matters may be set right by making a proper adjustment of the radius rods.

To test the front wheels, manipulate the steering gear until measurements show one wheel to be parallel to its spring; it will be necessary to adjust the drag link, which is the bar connecting the steering arms of the two knuckles.

Another method of testing the wheels is to stretch a string along the sides of a front and rear wheel, just above the axle. With the steering gear set for straight running the string should touch each wheel at two points, as indicated in the diagram. If the wheels are not true, the string will touch at one point only, as illustrated.

LOCATING ENGINE NOISES.

The writer was once called on to locate a knock in an automobile engine belonging to a doctor. There was no question as to the cylinder, nevertheless even the use of a stiff wire, one end held in the teeth and the other resting against the engine, failed to determine whether the trouble was in the crank pin or wrist pin.

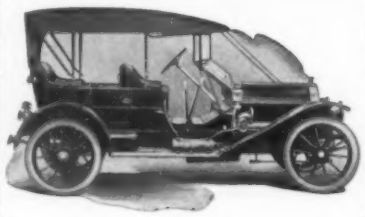
The sight of a stethoscope in the doctor's pocket suggested its use, and the knock was immediately located in the wrist pin. A stethoscope now takes an important place in the writer's testing equipment, and he believes that it will be found invaluable in the repair shop. By its use looseness in a bearing may be detected long before it becomes serious, escaping gases may be heard hissing past worn piston rings or pitted valves, and other noises that indicate slight faults are brought to the attention of an intelligent user.

TIMING MAKE-AND-BREAK IGNITERS.

Under usual conditions it is difficult to time igniters with any degree of accuracy, but it may be accomplished with surprising ease by the use of an electric bell, a battery and wire. One side of the battery is to be grounded, the other connected to the bell, and the circuit continued to the insulated part of the igniter, as shown in the diagram. When the igniter is not making contact the bell circuit is open, but when the piston is moving on a compression stroke the igniter makes contact, and the bell rings.

When the spark control lever is in the retarded position, the igniter should break contact when the piston reaches the top center of the compression stroke. To make the adjustment, crank the en-

(*Concluded on page 74.*)



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The Discovery

Here is an outline of the story—just enough to make you want it all.

Two years ago, Mr. John N. Willys was a dealer in automobiles. There came to him one day a remarkable car—evidently the creation of a mechanical genius. The simplest, sturdiest, smoothest-running car that anyone around there had seen.

The name of the car was the Overland. And the price—then $1,250—was as amazing as the car itself.

The sale of this car spread like wildfire. Each car sold brought a call for twenty others like it. Old and new motor car owners came by the score to deposit advance money—attracted by the Overland's matchless simplicity.

But the cars did not come. And when Mr. Willys went to the makers he found them on the verge of receivership.

The genius which had created this marvelous car could not finance the making, in the face of the 1907 panic.

The New Start

Mr. Willys in some way met the overdue pay roll—took over the plant—and contrived to fill his customers' orders.

Then the cry came for more cars from every place where an Overland had been sold. As the new cars went out the demand became overwhelming. The factory capacity was outgrown in short order. Then tents were erected.

Another factory was acquired, then another; but the demand soon outgrew all three.

During the next fiscal year these factories sent out 4,075 Overland cars. Yet the demand was not half supplied.

Dealers fairly fought for preference. Buyers paid premiums. None could be content with a lesser car when he once saw the Overland.

All this without advertising. About the only advertising the car ever had was what users told others.

The Pope-Toledo Plant

Mr. Willys' next step was to buy the Pope-Toledo factory—one of the greatest automobile plants in the country. This gave him four well-equipped factories—just 16 months from his start.

But the Toledo plant wasn't sufficient. So he gave his builders just 40 days to complete an addition larger than the original factory.

Then he equipped these buildings with the most modern machinery—with every conceivable help and convenience—so that cars could be built here for less than anywhere else.

Now 4,000 men work on Overland cars. The output is valued at $140,000 per day. The contracts from dealers for this season's delivery call for 20,000 cars.

Now this man has acquired 23 acres around his Toledo plant. And his purpose is to see—from this time on—that those who want Overlands get them.

Marvelous Sales

Dealers had ordered 16,000 of the 1910 Overland models before the first car was delivered. That means that each Overland sold the previous year had sold four others like it.

And without any advertising.

This year's Overland sales will exceed $24,000,000. Yet the Overland is but two years old.

The $1,000 Overland

This year an Overland—better than last year's $1,250 car—is being sold for $1,000. That is because the tremendous production has cut the cost 20 per cent.

A 25 horse-power car, capable of 50 miles an hour, for $1,000, complete with lamps and magneto. Never did a maker give nearly so much for the money.

There are higher-powered Overlands for $1,250—$1,400—$1,500. They are just as cheap in comparison as the $1,000 model.

The Overlands are unique in simplicity. They operate by pedal control. A ten-year-old child can master the car in a moment.

They are made in the same factory, and by the same men as made the Pope-Toledo—a $4,250 car. The reason for the price lies in the production of 125 cars per day.

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The Willys-Overland Company
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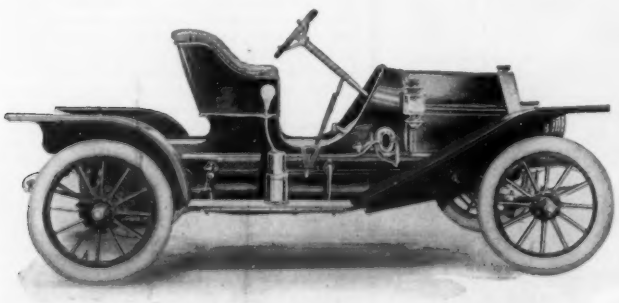

Overland Model 38—Price $1,000. 25 h. p.—102-inch wheel base. Made also with single rumble seat, double rumble seat and Toy Tonneau at slightly additional cost.

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All prices include Magneto and full lamp equipment

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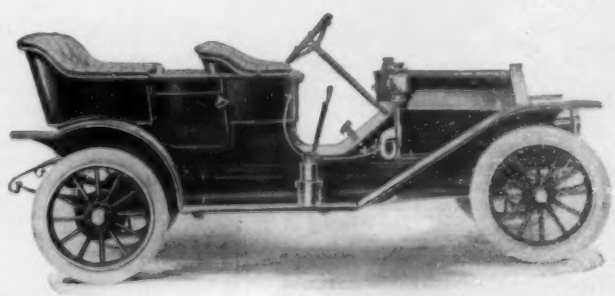

Overland Model 41—Price $1,400. 40 h. p.—112-inch wheel base—5 passengers. Five lamps and Magneto included.

(Concluded from page 72.)

gine until the piston is in this position, and then adjust the tappet until the igniter just breaks contact and the bell stops ringing. To test, crank the engine until the piston again makes a compression stroke and the bell begins to ring. Continue to crank, proceeding slowly, and observing the position of the piston by means of a wire passing through a relief cock, or by marks on the flywheel. The bell should stop ringing at the instant when the piston reaches its topmost point.

LACING A FAN BELT.

The requisites for joining together the ends of a flat lacer belt are rawhide lacing ¼ or ⅜ inch wide, and a round punch of such size that it will cut a hole in which the lacing will make a snug fit. For a fan belt of average width three holes may be punched in each end, the outside holes ⅜ inch from the end, and the center one ⅝ or ¾ inch in, the holes in the two ends being in line. The relative positions of the holes are shown in the diagram. The lacing is passed through the holes in the manner indicated, and drawn tight. To secure the end a cut is made on each edge of the lacing, extending inwardly for one-quarter of the width, the knife being laid flat on the belt. The lacing is cut off ½ inch farther up. The end may then be flattened out, and the wings formed by cuts will prevent it from pulling through the hole.

The belt will stay in position only when the stitches in contact with the pulley are parallel to the pulley edge. If the belt is placed on the pulley so that the slanting stitches are in contact with the pulley face it will tend to ride off.

In an emergency heavy wire picture cord of the ordinary stranded variety may be used in place of rawhide. The only objection to its use is the click that it makes in coming in contact with the pulley.

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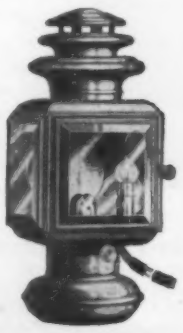

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RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

RECEPTACLE FOR BABY CLOTHS.—C. BREWER, New York, N. Y. The invention provides a receptacle for baby-cloths and other articles of wear offensive for manual handling, in which the washing may be performed; provides for operating the receptacle in the bowl of a water closet, utilizing the flushing water of the bowl, and wherefrom the water may be drained from the bowl; provides holding devices for the receptacle to retain the same in operating position; provides for flushing water in the bowl, and means for preventing flooding of the bowl to overflow the same.

Of Interest to Farmers.

COTTON-PICKER.—G. SICKEL, St. Joseph, Mo. The objects of the inventor are to provide a mechanical contrivance for picking cotton; a device for mechanically controlling the cotton as picked; and a mechanism which will perform its functions without damage to the growing plants and to lessen the labor incident to picking by hand.

WEED-EXTERMINATOR.—E. A. FRANCIS, Marshalltown, Iowa. The intention here is to provide a device compact in form, so that it can be easily carried about by the operator, and which is so constructed that the mechanism whereby the liquid is discharged from the body will not become clogged by dirt as the lower end of the body is forced into the ground.

AUTOMATIC FOWL-DUSTER.—O. E. BUFFUM, Enumclaw, Wash. The invention has for its object a duster in which the container for the dusting material is movably mounted and driven by the frictional contact of the fowl in passing under it, the container being adjustable to different elevations to suit fowls of varying heights.

TRIP MECHANISM FOR CORN-PLANTERS.—H. E. HERBRANDSON, Alcester, S. D. The purpose of the invention is to provide an improved trip mechanism, especially adapted for use with corn-planters, but capable of use in any device where it is desirable to operate one part intermittently by means of a continuously moving part.

Of General Interest.

REINFORCED CONCRETE CONSTRUCTION.—S. H. SUMMERSCALES, Winnipeg, Manitoba, Canada. The improvement refers to reinforced concrete construction, and the object is to provide a simple construction in which the metal reinforcing parts are connected in a manner so as to form an efficient reinforcing skeleton for concrete walls, floors and similar constructions.

BRACE FOR BRICK-KILNS.—A. PERUSSE, Kingston, N. Y. In this case the object is to provide a brace which is adapted to brace the sides of a brick-kiln to serve as a support while the bricks are being baked. The brace is adjustable so that it may be fitted between a side of the kiln and a framing spaced therefrom, without endangering the workmen in charge of the work.

LOOSE-LEAF-BINDER POST.—F. H. CRUMP, Los Angeles, Cal. The posts are provided with a head which will so engage the top binder plate as not to protrude through it. The bolt (male and female) will remain together when the top cover has been removed. The post is for use with a round hole sheet, which will not come off the post though held loosely between the covers.

SCALE.—C. M. STURGIS, Birmingham, Ala. The principal objects here are to provide a structure which may be readily extended, a structure wherein the moving parts are securely and simply mounted, a structure having a multiplicity of carrying beams with a single adjusting member; one wherein the platform may be supported upon end rails without interfering with the moving parts of the scale proper.

LOOSE-LEAF BINDER.—J. M. LULL, Wausau, Wis. The invention relates to a special form of binder for holding the sheets of loose leaf books. The patentee provides for each group of leaves a novel form of clamping plates having specially designed interlocking lugs that clamp the plates together and engage the leaves of the book.

Hardware.

WINDOW-LOCK.—I. C. SCUDDER, New York, N. Y. The invention relates to certain improvements in window locks, and more particularly to a locking device adapted to be detachably secured to the lower portion of the upper sash to limit the extent to which this sash may be lowered or the lower sash raised.

JACK.—W. B. MCCAIN, Clearlake, Wash. The jack in this improvement is of the double action type and in operation lifts the load step by step or lowers it in like manner, according to the relative disposition of certain parts and it is provided with means for entirely releasing the lifting bar, whereby the latter may drop instantly to initial position.

HASP-FASTENER.—H. L. LAMBRECHT, Sullivan, Ill. The invention is an improvement in hasp fasteners, and has for its object a construction in which the latch bolt is automatically engaged in a notch or recess in the keeper when the hasp is swung to locking position, thus preventing the withdrawal of the hasp until the latch bolt is retracted.

PITCH-BOARD.—C. E. LYTLE, St. Joseph, Mo. This measuring instrument is more especially designed for use by carpenters to enable them to accurately obtain the length and bevels of rafters, thus enabling a carpenter to frame the roof of a building with ease and dispatch and without the use of a square or a bevel and without requiring mental calculations.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12168) J. R. U. says: 1. Could you tell me the supposed speed of Arcturus per minute and its probable distance from the north star? A. It is difficult to give a velocity for Arcturus. The researches of Prof. Elkins some years ago are fully reported in our SUPPLEMENT No. 809, price ten cents. These tend to make us believe that the velocity of Arcturus is very high, about 380 miles a second, and its distance from the earth about 180 light years. The approach of Arcturus toward the earth is about 53 miles per second. These researches were published nearly twenty years ago, yet there are no later determinations, and they are the ones given in our textbooks of astronomy. We do not know its probable distance from the north star. Probably that has not been determined. 2. Is the north star the center of attraction around which the circumpolar constellations move? A. The north star is simply the star which at present happens to be nearly in the line of the earth's axis prolonged to the celestial sphere. As the earth's axis is in motion around the pole of the ecliptic, the pole will move away from the present pole star and will not return to its present position till 25,000 years have passed. The pole star is not a center of attraction in any sense. It is simply a pole star to the earth at the present time, and the constellations seem to move around it as seen from the earth and not as seen from other stars.

(12169) G. F. B. says: I would like

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to secure a book giving a complete course of experiments in physics for the first year in high school. It is especially in electricity I would like a course, beginning at the very bottom and working up by simple and readily intelligible experiments. Have you such a book, or can one be procured from some of the large book supply houses? A. We recommend and can supply you with Carhart and Chute's "High School Physics," for $1.35 postpaid, and also Chute's "Laboratory Manual of Physics," for 90 cents postpaid. With these you will be equipped for learning the work in elementary physics up to the entrance to college. The work is graded just as you request, and is just what is done by everyone fitting for college in the United States to-day.

(12170) J. S. says: 1. What is the exact length of a sidereal and a tropical year? A. The sidereal year is in mean solar time 365 days, 6 hours, 9 minutes, 8.97 seconds. The tropical year is in mean solar time 365 days, 5 hours, 48 minutes, 45.51 seconds. These are not exact, but are correct within a hundredth of a second. 2. What do you hold of water witching? Do you think a person can locate water in the ground with the aid of a forked switch? A. We do not "hold" anything about "water witching." We do not believe that water can be located underground by a stick.

(12171) A. J. H. says: Some time ago you had an explanation published in your SCIENTIFIC AMERICAN of how a square of 64 inches on changing the angles became an oblong with 65 squares. Please advise me how this is done and where the fallacy comes in. A. You will find the explanation of the fallacy of the cardboard square, cut to appear to increase one square inch in area, in our Notes and Queries of Vol. 99, No. 21, which we send for ten cents. The article occupies more than a column and is illustrated by drawings to scale.

(12172) H. C. A. says: What is the chemical symbol for litmus? How is litmus paper made? Why do the acid and alkali have the property of changing the color of it? A. Litmus is a natural dyestuff of unknown chemical structure. Doubtless one of its colors is that of the molecule, the other that of its ion. Litmus paper is made by preparing a solution of litmus in water, soaking filter paper in the solution, and allowing it to dry. If red litmus paper is desired, the solution is reddened by a drop of an acid before the paper is dipped into it.

(12173) E. R. S. says: Please decide this question and oblige a subscriber: A states that in sending a message by telephone the transmitter vibrates, and this vibration travels over the wire by an electric current. B states that when the transmitter and receiver are fully connected between given points of any distance, that space is eliminated in the sending of a message, therefore no travel is necessary or time consumed. A. If we understand your statements, neither A nor B is wholly right. We should state the action of the telephone in this way: When the diaphragm of a transmitter vibrates, the variation of pressure upon the carbon particles in the transmitter causes an undulation in the current from the transmitter to the receiver at the other end of the line. In this receiver an undulation is produced of the same period as that in the transmitter. This causes a vibration of the diaphragm of the receiver, which is heard as a sound by the person who is receiving the message. Along the line a varying electric current flows. There is only an electric current along the line. There is sound at both ends. The same time is required for the impulse to travel from transmitter to receiver as would be required for a telegraph signal to travel over the same wire to the same distance.

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EVERY practical mechanic, whether amateur or professional, has been confronted many times with unexpected situations calling for the exercise of considerable ingenuity. The resourceful man who has met an issue of this sort successfully seldom, if ever, is averse to making public his methods of procedure. After all he has little to gain by keeping the matter to himself and, appreciating the advice of other practical men in the same line of work, he is only too glad to contribute his own suggestions to the general fund of information.

About a year ago it was decided to open a department in the Scientific American devoted to the interests of the handy man. There was an almost immediate response. Hundreds of valuable suggestions poured in from every part of this country and from abroad as well. Not only amateur mechanics, but professional men as well were eager to recount their experiences in emergencies and offer useful bits of information, ingenious ideas, wrinkles or "kinks," as they are called. Aside from these, many valuable contributions came from men in other walks of life—resourceful men, who showed their aptness at doing things about the house, in the garden, on the farm. The electrician and the man in the physics and chemical laboratory furnished another tributary to the flood of ideas. Automobiles, motor cycles, motor boats and the like frequently call for a display of ingenuity among a class of men who otherwise would never touch a tool. These also contributed a large share of suggestions that poured in upon us. It was apparent from the outset that the Handy Man's Workshop Department in the Scientific American would be utterly inadequate for so large a volume of material; but rather than reject any really useful ideas for lack of space, we have collected the worthier suggestions, which we present in the present volume. They have all been classified and arranged in eight chapters, under the following headings:

I, Fitting up a Workshop; II, Shop Kinks; III, Soldering of Metals; IV, The Handy Man in the Factory; V, The Handy Man's Experimental Laboratory; VI, The Handy Man's Electrical Laboratory; VII, The Handy Man About the House; VIII, The Handy Sportsman; IX, Model Toy Flying Machines. Index.

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NEW BOOKS, ETC.

EXTRACTS AND PERFUMES. By Wilbur L. Scoville, Ph.G. Boston: The Spatula Publishing Company. 16mo.; 101 pp. Price, $1.

This is a valuable treatise on the most practical methods for the manufacture by the retail or wholesale pharmacist of flavoring extracts, colognes, toilet waters, perfumes, sachets, fumigating pastilles, etc. It is an excellent book on the subject.

THE PREVENTION OF INDUSTRIAL ACCIDENTS. By Frank E. Law, M.E., and William Newell, A.B., M.E. New York: The Fidelity and Casualty Company of New York, 1909. 16mo.; 194 pp. Price, 25 cents.

The prevention of industrial accidents is one of the most important subjects which have come to the fore in the opening years of the present century. The American Museum of Safety and Sanitation has obtained a more or less secure foothold in the counsels of great manufacturers, and great industrialists are to be found on its board of trustees. Strange to say, the insurance companies, instead of being antagonistic, have done everything in their power to support and promote this movement, and they have, may it be said to their credit, contributed much of the sinews of war to the organization referred to and to similar enterprises. The position of the SCIENTIFIC AMERICAN as regards the

prevention of industrial accidents is indicated by the fact that this journal offered a prize, a handsome gold medal, for the best device for safe-guarding life and limb, and this medal is awarded annually when there is a competition held by the American Museum of Safety and Sanitation. The small pamphlet before us is filled with information of the greatest possible value, and it is truly a "life saver."

HOLLAND OF TO-DAY. By George Wharton Edwards. New York: Moffat Yard & Co., 1909. 8vo.; 217 pp. Price, $6.

It is a pleasure to look through this splendidly made book, in which the author-artist and the publisher have collaborated to produce a *chef d'oeuvre*. Mr. Edwards is an accomplished master of line and a brilliant colorist, and the somewhat gaudy tints of a Holland costume and landscape are brought into their proper key in the splendidly colored illustrations with which the book is embellished. To those who know their Holland well this book is a great treat, while it is especially commended to those who are unfamiliar with this tight little country, and to whom it will serve as an excellent guide. The text is a matter-of-fact description of what the traveler may find in Holland to-day, and he will glean many interesting facts, such as the plurality of cheeses at breakfast, the growth of tulips, and information as to the head-dresses of Friesland. The illustrations showing old Dutch silver are particularly valuable. The binding is most sumptuous.

THE SPATULA LABEL BOOK. By Wilbur L. Scoville, Ph.G. Boston: The Spatula Publishing Company. Price, $1.

This valuable book is indispensable to the druggists, comprising labels for practically all the drugs, chemicals, and preparations of the United States Pharmacopœia and the National Formulary, together with many for drugs in the British Pharmacopœia, and for a large number of unofficial articles, utensils, apparatus, etc., in all over 2,000 labels. These labels are printed in large type on paper which is easily pasted on bottles, drawers, etc. It is worthy of a considerable distribution.

TIME AND ITS MEASUREMENTS. By James Arthur. Chicago: Popular Mechanics, 1909. 8vo.; 64 pp. Price, $1.50.

This rather interesting book describes ancient methods of keeping time, Japanese clocks, modern clocks, and the astronomical foundation of time. It gives a considerable amount of information not readily obtainable elsewhere.

HAND BOOK OF BRITISH GUIANA. 1909. Edited and compiled by George E. Bayley of the British Guiana Civil Service. Georgetown, Demerara, British Guiana. 8vo.; 607 pp. Price, $2.

This portly volume describes everything which anybody would possibly want to know about British Guiana, and is a most creditable work on a most beautiful and interesting country.

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INVENTORS are invited to communicate with **Munn & Co., 361 Broadway, New York,** or **625 F Street, Washington, D. C.,** in regard to securing valid patent protection for their **inventions. Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

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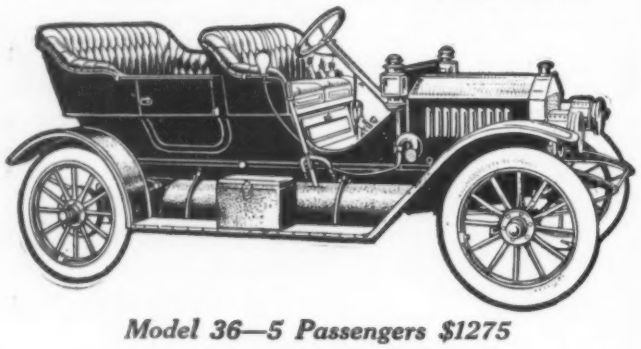

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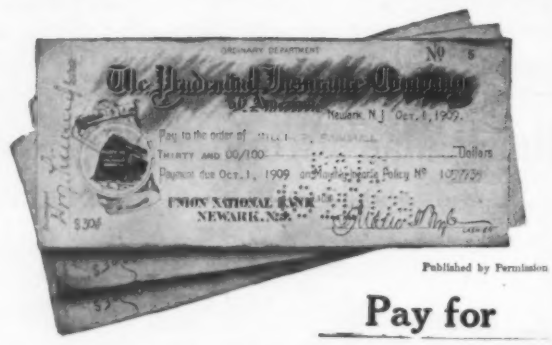
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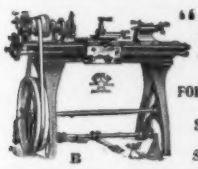

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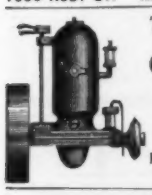

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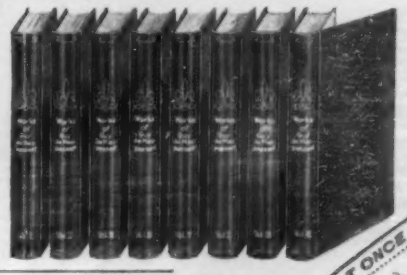

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A.—WANTED, Wireless patents. Advertiser desires to purchase wireless telephone and telegraph patents for either Canada or the United States, or both. Write stating full particulars and cash figure on same. Address L. V. U., Suite 625, 41 Park Row, New York City.

Inquiry No. 9025.—Wanted, address of rubber manufacturers in Germany.

MISCELLANEOUS.

Inquiry No. 9029.—Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

HAIR GROWS when our Vacuum Cap is used a few minutes daily. Sent on 60 days' free trial at our expense. No drugs or electricity. Stops falling hair. Cures Dandruff. Postal brings illustrated booklet. Modern Vacuum Cap Co., 856 Barclay Block, Denver, Colo.

Inquiry No. 9036.—Wanted, the address of the manufacturers of "Cycle Ball Bearing Suspenders."

LISTS OF MANUFACTURERS.

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9042.—Wanted the address of Farney Safety Razor Co.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9044.—Wanted to buy outfits necessary for agate polishing.

Inquiry No. 9046.—Wanted, machinery used for the manufacture of all kinds of fruit boxes, baskets and crates.

Inquiry No. 9048.—Wanted, address of manufacturers of metal table slides for extension tables.

Inquiry No. 9049.—Wanted, to buy rotary brushes suitable for a shoe shining machine.

Inquiry No. 9052.—Wanted to buy machinery etc., for a beer plant, that manufactures beer by means of glucose.

Inquiry No. 9053.—Wanted, address of firms who install plants to manufacture nitrogen.

Inquiry No. 9054.—Wanted, address of manufacturers of articles made from mica.

Inquiry No. 9055.—Wanted, address of parties interested in Log Cleaning Machines.

Inquiry No. 9056.—For manufacturers of window shades.

Inquiry No. 9057. For manufacturers of glass and china balls, used as fixtures or ornaments on lighting rod equipment, also weather vanes for same purpose.

Inquiry No. 9058.—Wanted, firms who make machinery used for pulverizing soap-stone.

Inquiry No. 9059. For manufacturers of flexible steel chain mail.

Inquiry No. 9060.—Wanted to buy machinery to manufacture seed corn racks.

Inquiry No. 9061.—Wanted the address of manufacturers of auto magnetos and permanent magnetos.

Inquiry No. 9062.—Wanted to buy a plant for manufacturing muriatic acid.

Inquiry No. 9063.—Wanted to buy a machine that would wrap and tie up a loaf of bread.

Inquiry No. 9064.—For manufacturers of a cigarette making machine constructed as follows, a small metal box containing tobacco and papers, the cover contains a piece of cloth upon which is placed the paper and tobacco, the cover being closed the cigarette jumps forth.

Inquiry No. 9065.—Wanted to buy a second hand telephone generator.

Inquiry No. 9066.—Wanted complete outfit for export for making rice flakes and wheat-flakes.

Inquiry No. 9067.—Wanted the address of makers of the Standard Folding Typewriter.

Inquiry No. 9068.—Wanted to buy machinery for manufacturing chewing gum, such as rolling, cutting or wrapping machinery.

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Horseshoe with elastic bridge covering both ends, E. Schmitz	945,289
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Insulator clamp, J. Blackburn	945,213
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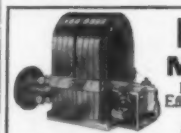
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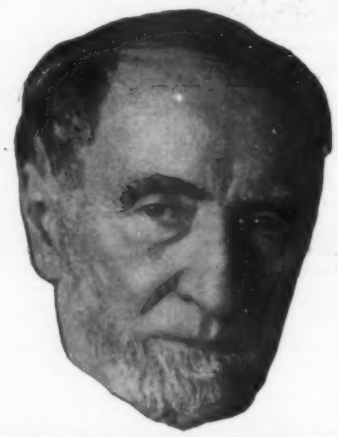

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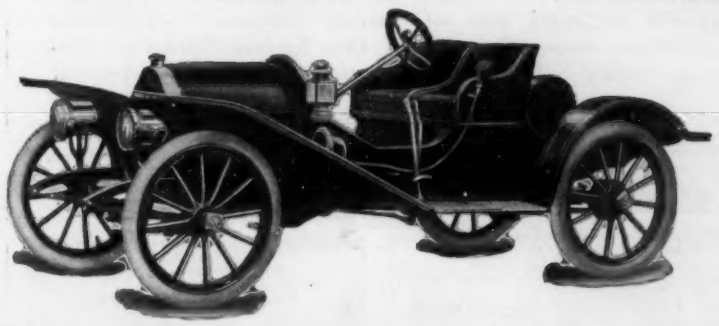

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Cooling. Thermo-syphon in combination with 16-inch fan.

Front Axle. Drop forged "I" beam of exceedingly neat design.

Rear Axle. Shaft driven. Ball and roller bearing throughout.

Springs. 2 semi-elliptic springs in front; 1 cross spring in rear, giving three-point suspension, insuring remarkably easy riding.

Wheels. Artillery type. 32 x 3 clincher tires. Wheel base, 96 inches. 56-inch tread.

Steering Gear. Irreversible type. One control lever.

Brakes. 2 sets of internal expanding brakes.

Weight. 1,200 pounds complete.

Equipment. 2 dash and 1 tail oil lamp; horn; tire repair and tool kit.

Price. Runabout, $800. Roadster, $825, with single rumble. Surrey, $850. f. o. b. Detroit.

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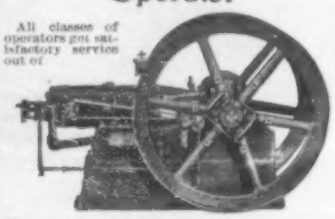

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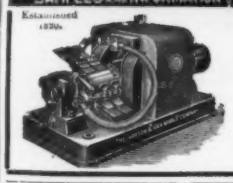

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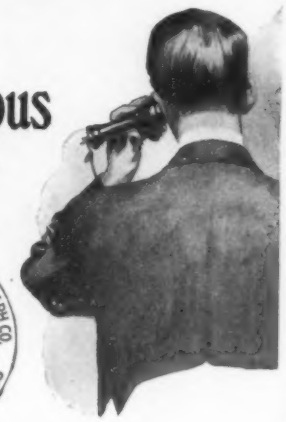

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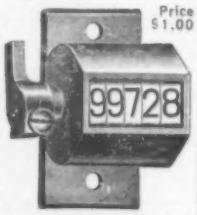

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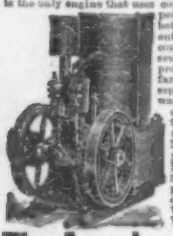

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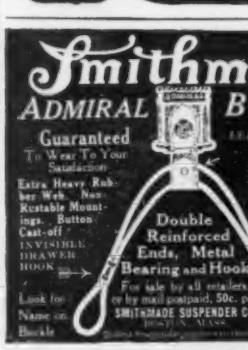
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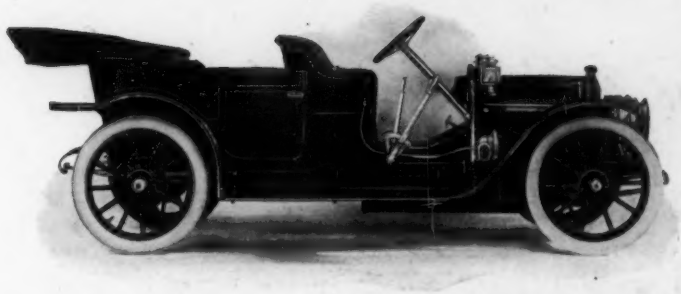

We Have Been Two Years Writing This Advertisement

In two seasons of motor contests Chalmers-Detroit Stock Cars have won 89 FIRSTS, 32 SECONDS and 21 THIRDS

You do not want a racing car. Neither do we. We have never built one.

We have not gone into races merely for the fun of it. It is simply a cold dollars and cents business proposition. We have gone into contests because we believed that was the best way to prove our cars.

We spent last year a good many thousands of dollars in automobile contests. **One-third of this amount we charged to advertising expense. Two-thirds we charged to Engineering expense**—because this is the best experimental work we know.

We are determined to build the best cars in the world at the price, and so long as we think contests help us do that, we shall remain in contest work.

We have never claimed to make the best cars in the world—but the best cars in the world **at the price.**

True, there are many people who believe Chalmers-Detroit cars are the best cars made regardless of price—those people are owners of

Chalmers-Detroit Cars

Not a Few Contests, but Many

In two years Chalmers-Detroit cars in prominent automobile contests have won 89 firsts, 32 seconds, and 21 thirds.

This includes road races, track races, hill climbs and endurance contests.

Our "30" Sets World's Record

In the past two years there have been in America six—and only six—great road races for light cars. Chalmers-Detroit "30's" have been entered in all six and they have won *five firsts, and one second and one third.* In no race did they fail to show. Here is the full story:

First and second in Jericho Sweepstakes, Long Island Motor Parkway, October, 1908.

Third in the 200 mile International Light Car Race at Savannah, November, 1908.

First in the Indiana Trophy Race, June, 1909, when Matson averaged 51.5 miles per hour for 232 miles, making better time than the winner of the Big Car Race of the following day.

First in the Santa Monica (California) 202 mile race, July, 1909, where it set a world's speed record for light cars of 55.5 miles per hour.

First in National Light Stock Car Event at Lowell, Mass., September, 1909. Driven by William Knipper 127 miles at an average speed of 52 miles an hour.

As a climax, this greatest of light cars, driven by Matson in the last Vanderbilt Race, again set a new world's light car speed record by averaging 58.5 miles an hour, winning the Massapequa Cup. Not once during the race did this car stop, and it defeated the nearest competitor by nineteen minutes.

100% of Victories

The record of the "30" at the opening of the new Atlanta two-mile motor track last November has never been equaled.

Two "30's" driven by Knipper and Matson, won every event offered in their class. Whenever both cars were entered in an event, second place was taken as well as first.

Both cars finished every event started.

Both cars averaged a mile a minute for every minute they were running on the track.

For the week the Chalmers-Detroit tally stood five firsts, eleven seconds and eight thirds—the best average showing made. Yet many of the finest cars—foreign and American—were there.

Winner in Glidden Tour

The record of the "Forty" also is wonderful.

The "Forty" won the Detroit Trophy in the Glidden Tour, this year, the longest and hardest automobile touring contest ever held.

It has won twice in succession the Minneapolis Tribune Trophy in the two-day endurance test.

It won the Perpetual Challenge Trophy in the Pasadena-Altadena Hill Climb, the most coveted trophy in California.

Driven by Dingley, it won the Wemme Trophy at the Annual Rose Festival Road Race at Portland, Oregon, doing 103 miles in 104 minutes.

It won in its class at the Sport Hill Climb, and set a new record for the course. At the Dead Horse Hill Climb, Worcester, Mass., the "Forty" won two firsts, one second, and two thirds.

At the Readville, Mass., track, a "Forty" won the ten-mile event, and in the race for the Howard Trophy, at 25 miles, covered the distance in 24 minutes, 45 seconds, forcing a specially constructed foreign track racer to establish a new world's record for this distance in order to win.

Defeats Fifteen Bigger Cars

Driven by Lorimer, the "Forty" won the 100-mile and the 10-mile events in the Point Breeze Races at Philadelphia, also the 100-mile Motor Marathon at the Brighton Beach Track, New York City.

In the 200-mile road race over the Fairmont Park course in Philadelphia, the "Forty" defeated one 90 h. p. car, four 70 h. p. cars, seven 60 h. p. cars, and three 50 h. p. cars. It was beaten by only one car—a 90 h. p. giant, more than twice as big and twice the price, and then only by four minutes.

The "Forty" was awarded the "Consistency Prize" because it did not stop a single time during the race.

Bert Dingley has driven a "Forty" all the past season. Of the many road races he started he failed to finish in but one. On this showing *Motor Age* awards him the title of premier American driver of the year.

How Private Owner Profits

But the prospective owner may ask: what does all of this mean to me?

It means simply that the Chalmers-Detroit Motor Company has proved, for your benefit, that its cars are everything they claim they are—the best cars in the world at the price.

Every car the Chalmers-Detroit Company has entered in an automobile contest has been **strictly a stock car.** We have never built a racing car.

Looking to Improve

If there is anything wrong with our cars we want to be the first to find it out. This is another reason we go into contests.

A 200-mile road race at sustained speed of 40 to 80 miles an hour puts a car to a severer test than the average owner could put it to in a whole year's use.

If there is a weak spot in a car it will be discovered under the strain of contests, and the improvement can be made. They show you where improvements can be made.

Therefore—**the private owner is the one who gains most from our automobile racing.**

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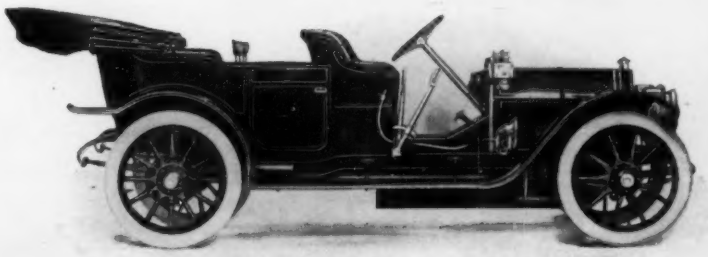

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